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ECOLOGICAL INTERPRETATION IN ARCHAEOLOGY: PART I

C. W. Meighan, D. M. Pendergast, B. K. Swartz, Jr., and M. D. Wissler

INTERPRETATIONS of man's relationship to his environment are basic to the understanding of archaeological data. Such interpretations are made by almost all archaeologists in the course of presenting their findings, and there is a growing trend toward more precise delineation of human ecology in prehistoric times. Yet much archaeological writing of this sort tends to be sketchy and fragmentary, and techniques of value are often overlooked or ignored. More or less standardized procedures for interpreting prehistoric ecology are still in the process of being worked out, and even the physical techniques of collecting and sorting samples are experimental at present. As a result, the standard manuals dealing with archaeological techniques say little or nothing on the subject of collecting and analyzing specimens for ecological purposes. This paper attempts to organize and outline the methods whereby the archaeologist can draw conclusions about man in his relationship to nature. We have assembled information on collection techniques and present examples of inferences drawn from the data.

To avoid an overgeneralized approach, we have limited this discussion to only part of the available archaeological cultures—namely those of hunter-gatherer groups. This seems a useful starting point because hunters and gatherers are closely adjusted to environmental conditions and hence our techniques are most important in studying cultures of this sort. Many of these techniques and interpretations may also be applied to sites representing agricultural communities, but we have not specifically studied agriculture here because it involves special study of domesticated plants, irrigation systems, and other things which take us away from the kind of direct adjustment to environment characteristic of hunters and gatherers. We have also omitted discussion of specialized archaeological techniques which are used primarily for chronological or other interpretations. Thus pollen analysis and dendrochronology, although they give direct evidence of climate and plant life and hence the environment of a given site, are not here considered since their primary applications have been chronological and their secondary applications fairly familiar.

It is certain that we have missed many references and have overlooked some ingenious and important approaches to ecological studies in archaeology. Yet in compiling our information, we have been surprised at the scant treatment given this important topic in the literature. Many of the standard journals and publication series were checked volume by volume for information, with meager rewards, and there are dozens of modern site reports which omit all mention of ecological factors. Where there is discussion, it is often of the most superficial and impressionistic sort. Of the hundreds of shell middens which have been excavated and reported, only a few have so much as species lists for the shellfish present in the site; still fewer have any sort of quantitative data on the relative importance of each species. Of the reports which present species lists of faunal remains, few make any inferences from them. From our survey of this subject, we feel that a greater refinement of ecological interpretations is one of the most needed developments in the advancement of scientific archaeology.

An additional word on the references cited — they are intended as examples and not as comprehensive listings of all known instances. Being more familiar with western American archaeology, we have more easily cited examples from this area. The overemphasis on the west in our bibliography is thus a matter of convenience in study and is not intended to slight instances of ecological interpretation for other regions. It is worth noting, however, that studies in western North America have contributed considerably to ecological approaches, probably largely because the archaeology here lacks elaborate remains, making ecology one of the more fruitful lines of investigation (see for example Heizer and Cook 1956).

Settlement Patterns and Population

Valuable data on man's adaptation to environment may be derived from studying the density, distribution, and depth and configuration of archaeological sites. Several studies involving agricultural settlement patterns have been made (Willey 1956; Crawford 1953; Childe 1950; Ricketson and Ricketson 1937), but similar studies applied to hunting and gathering sites are still limited in number and extent.

An obvious technique used by several authors is simply to correlate the distribution of sites with the distribution of resources or natural features of the environment. For example, Clark (1952: 23) indicates the correlation between Magdalenian sites and the distribution of reindeer. The Sangoan culture of Africa seems to occur within areas now having over 40 inches of rainfall (Cole 1954: 153, Map 6, Nos. 3, 4). For hunting and gathering peoples, such correlations should be the rule rather than the exception, and we may expect to find relationships between site distribution and natural features in any case where a sufficiently large number of sites is known and plotted on a map.

Aerial photographs provide another technical aid for study of settlement patterns. Crawford (1953) and Solecki (1957) discuss types of evidence and methods of interpretation. Soil color differences are a very important guide to detection of midden areas which are frequently darker than the surrounding soil. In "crop sites," the site is revealed by a vegetation difference, due to some particular plant growing only on the site, or a more luxuriant or scantier growth of various plants where the soil has been altered by human occupation. In California, sites have been observed to have an abundance of such plants as thistles, mustard, buckeye trees, or cactus. Since midden sites differ chemically from the surrounding soil, almost any site should show as a crop site at one season or another.

Aerial photographs have been used in a limited way in this country, but their application could be greatly extended. However, there are some practical problems in the way of studying hunting-gathering sites from air photos. In the first place, the average hunting-gathering site is quite small and therefore may not be revealed in commercial air photos taken from high altitudes. In a spot check of a dozen sites on the west coast, none could be detected from the commercial air photos now available.

Whether or not aerial photographs of an entire district can be taken, ecological information of value can often be obtained from studying an air photo of a single site. Such photos may sometimes be taken from a kite or balloon (Bascom 1941; Roy 1954), but a low-level aerial photograph is usually easier to obtain. If topography permits, such a photo can be taken from the top of a nearby hill or cliff (Goodwin 1953). The picture is likely to reveal unsuspected drainage patterns as well as the exact borders of the site and the relationship of the site to the local vegetation zones (Crawford and Keiler 1928; DeLauwe 1951).

A final technique involves the calculation of site areas. Knowledge of area is important in such things as population estimates. The simplest method is to prepare the site map on graph paper and calculate the area from counting the squares, since the irregular shape of many sites makes it difficult to apply mathematical formulae to the computation of area.

The relationship between site distribution and food resources has already been mentioned. In arid regions, availability of water may be a primary consideration for location of a village, and location of sites along streams is common throughout the world. Other reasons for selecting a village location include defense, dryness, shelter from prevailing winds, exposure to morning sunlight, and elevation for unobstructed view of surrounding country.

There are some additional ecological interpretations, commonly made by archaeologists but not often explicitly discussed in the literature. These include interpretation from the size and configuration of sites. Correlations include:

1. Where the midden is deep but of limited area, forming mounds as much as 10 m. deep and only 100 m. in diameter, one may assume that the population was small (otherwise the living debris would be more scattered) and that the people were short-range foragers, obtaining their living from a limited area. Shell middens are common examples of this sort of site. Population is assumed to be of the band type, averaging perhaps 100 people.

2. Where the midden is shallow but of considerable extent, forming rather flat sheets of debris about 1 m. deep and up to 300 or more meters in diameter, the population was probably relatively great (as high as 1000 or more), but the people were again short-range foragers.

3. Where there are small patches of midden (1 to 5 m. in diameter, less than 15 cm. in depth) over a very large area, representing overnight stops, one or 2 house

sites, or single meals of small groups, one can infer a small population of long-range foragers with a "feast or famine" subsistence level. Much of the Great Basin, parts of the Plains, Lower California, and Australia provide examples of such sites. Hunting by family groups of less than a dozen people is probably characteristic.

It is unfortunate that more precise information on population and size of sites is not available. The figures given above are estimates based on observation of historic sites of coastal California, but much more exact figures should be attainable where area/population data are worked out for historic sites in diverse ecological zones.

Other interpretations of great importance involve the calculation of aboriginal population. Some estimate of the number of people occupying a given area is essential to an understanding of ecological relationships, yet estimates of population are seldom made or interpreted by archaeologists. Inferences on population may be made from the following data:

1. House count. Counting contemporaneous structures and multiplying by a factor for family size.

2. Site area. A method developed by Cook and Treganza (1950: 231) shows a logarithmic relationship between site area and population presented by the formula *log population = constant x log area.* This most promising approach should be tested in other areas.

3. Size of cemeteries. Small and migratory populations are not likely to develop cemetery areas of any size. Several factors probably contribute to this situation — the death of individuals while on the move, failure to mark graves with consequent forgetfulness of grave locations, and the small number of people dying in any given generation. It is probably not possible to work out a precise formula expressing relationship between cemetery size and population size, but for midden sites on the west coast the following figures represent reasonable estimates:

No cemetery area; a few burials found at random in midden: population probably not over 50.

Cemetery areas with concentrations of 5 or 10 burials: band population, perhaps 50 to 100 individuals.

Cemetery areas with concentrations of 30 to 60 burials: population of perhaps 200 to 400 persons.

FIG. 1. Laboratory sorting of shell midden sample.

Cemeteries with over 100 burials: population probably over 500; may be over 1000.

Such figures cannot be applied indiscriminately, but they suggest that the population of a site can be computed as roughly 6 to 10 times the number of burials in a given cemetery. Needless to say, the cemetery must represent a relatively short time span for such an estimate to be made.

Midden Analysis

Turning from the kinds of information obtainable from examination of the whole site and its environment, we consider next the micro-analysis of the components of a midden. This is done by collecting and intensively analyzing small samples of the site itself. General papers dealing with physical analysis of sites include Cook 1950, Cook and Heizer 1951, and Cook and Treganza 1947.

Since it would be an impossible task to examine the average site by screening and weighing all the component materials, a column sampling technique can be employed. A common technique is to remove all the material from a column 4 inches square and sack the material by levels, 6, 10, 12 inches or whatever. The individual sample in this case usually consists of 4 to 8 pounds of midden material; the number of samples from each column naturally depends upon the depth of the site. Column samples are usually collected in a vertical column from the walls of an excavation pit. Each sample is labeled separately with site designation, depth, and location of the column. To facilitate recording, it is convenient to take the columns from a corner of an excavation pit. Visible concentrations of individual components (ash, shell) should be avoided in placing the column, since the aim is to obtain a section of homogeneous midden material. Column samples may also be collected with a soil auger. This is more difficult, since midden material from the upper levels is apt to fall or be scraped into samples from the lower levels. However, if used with care this technique is helpful for sites not being excavated.

The analysis of small samples is based on the assumption that the mound components are evenly distributed, abundant, and finely fragmented. That this is the case is shown by an important experimental study of Treganza and Cook (1948). The authors screened and weighed an entire midden, at the same time collecting samples of various sizes to determine the minimal sampling necessary to give an accurate measure of the site's constituents. They conclude that a series of small samples, from 15 to 25 in number, will yield a reasonably accurate picture of the over-all makeup of a midden site.

The analysis of a sample proceeds in 7 steps:

1. Dry the sample. Treganza and Cook (1948) dried their samples at 60°C. for one week.

2. Mix the sample and select 2000 grams for analysis, to reduce labor. This figure is known as the dry weight.

3. Screen the sample. The graduated nest screen of the type manufactured by the W. S. Tylor Company of Cleveland permits screening and sorting of materials to several sizes in a single operation.

4. Wash the screened remains. This is done by placing the sample on a screen with mesh smaller than sorting size and rinsing with water.

5. Dry the sample. This can be facilitated by spreading the material on paper toweling.

6. Sort the sample. All sorting categories should be established prior to sorting, so that only one operation is necessary. Small remains may be put on a glass surface and handled with tweezers (Fig. 1). A bright light is a useful aid. Excessive labor may be required in sorting the numerous small fragments. Discretion should be used in deciding how finely the materials should be sorted. Due to the tendency of certain materials to fracture more easily than others, biased results may be obtained if one fails to sort the smaller fragments. It is usually necessary to sort fragments down to and including those held by a ⅛ inch screen for accuracy.

7. Weigh the sorted groups separately. The percentages by weight of the basic components (residue, rock, clay, bone, and shell) can then be calculated (Fig. 2). The percentages of infra-component categories, such as composition for inorganic materials and species for organic materials, are calculated for each component.

Quantitative analysis, as employed in midden analysis, furnishes the archaeologist with data on proportions of natural materials used at a site. Remains of edible food resources may be translated into pounds of meat, a figure which, when correlated with estimated population, may yield average daily protein intake for the site inhabitants. Cook and Treganza (1950) have correlated bone and shell remains with the edible food supply they furnish, and they suggest the following ratios shown in Table 1.

Table 1. Relationship Between Edible Food and Bone and Shell Remains

	Weight of Edible Flesh	*Weight of Remains Preserved in Site*
Mammal and bird bone	20	1
Mussel shell	1	2.35
Clams (S.F. Bay)	1	3.5
Clams (Southern Calif.)	1	5

SHELL MIDDEN ANALYSIS

SITE: Wilmington Road (CS-1) Sorting size - material caught by 1/4" screen.

Provenience of sample:

Total weight of sample: 2000 grams. (dry weight)

COMPONENTS	Wt.	%	Wt.	%	Wt.	%
Residue	886.5	93.6				
Rock	0.5	0.03				
Bone	1.0	0.05				
Shell	112.0	5.6				
Charcoal	+	+				
	Total shell weight - 112.0 grams.					
SHELL SPECIES						
1 Plagioctnemium circularis	64.0	57.0				
2 Chione (TOTAL)	8.5	7.6				
3 Chione undatella			7.0	6.2		
4 Chione fluctifraga			1.5	1.4		
5 Ostraea lurida	21.5	19.1				
6 Tagelus californianus	16.5	14.7				
7 Crepidula onyx	1.0	0.9				
8 Haliotis cracherodii	0.5	0.4				
9 Unidentified	+	+				
10						
11						
12						
13						
14						
15						
16						
17						
18						

Date: 6-15-57 Recorder: M.W. Sorting time: 1 hour

+Trace present

FIG. 2. Shell midden analysis form.

Quantitative analysis can also prove useful in dealing with inorganic remains. Alterations in cultural selection of materials can be determined. Meighan (1955a) inferred that obsidian gradually gained favor as a manufacturing material in a site in northern California by noting the greater abundance of obsidian spalls in screened samples from the upper levels of the site.

Attempts have been made (Cook 1946) to correlate midden deposit, population density, and food consumption from information derived by quantitative analysis. Although speculative in part, results so far obtained indicate that with further refinement this technique may prove of considerable value.

Faunal Remains: Bone

Faunal remains, which may occur as one of the major components of habitation sites occupied by hunting-gathering peoples, are a potential source of significant interpretations concerning ecological adaptation. Detailed analysis of such material may provide the archaeologist with insight into such diverse areas of culture as hunting pattern and season of occupation of a given site, as well as various facets of nonmaterial culture not directly linked with food gathering.

The recovery of bone from a site presents no great problems to the excavator. Complete sampling, or recovery of all material from an excavated unit, is most desirable for counts of species and individuals (Cook and Treganza 1950); this usually requires collection by level of all recognizable bone fragments, since retention of only whole bones or large fragments may lead to considerable distortion of data. Separation by level of materials thus gathered is of importance in determining what changes, if any, have taken place in the fauna of the area or in the species preferred for food during occupation of the site. Such complete sampling does not usually involve intricate or difficult techniques, but recovery of calcined or otherwise damaged bone may present certain problems (White 1955a: 85-7). The bone recovered during excavation is usually stored in bags marked with excavation unit and level until such time as laboratory treatment is undertaken.

Laboratory analysis of faunal remains begins with cleaning and preparation of materials for study. The bone is washed and air dried to avoid damage from cracking or warping. Special care should be taken to clean and preserve the articulations, as well as larger shaft sections. After cleaning, the bones may be numbered in lots according to their provenience within the site; for this purpose a rubber stamp may be employed, although india ink is equally satisfactory.

Following preparation of the material, rough separation of mammal, bird, and fish bone may be undertaken, using tabulation sheets designed for this purpose. Tabulation at this level is of considerable importance, for in some cases no more than 10% of the faunal remains admit more specific analysis (Meighan 1954: 219). The bulk of the bone from a site may, therefore, offer no opportunity for species identification, although it is of significance in total count or in frequency analyses. The archaeologist should in any case attempt rough tabulation, since it forms the basis for more thorough examination either by the archaeologist himself or by a zoologist.

Subsequent to rough tabulation, identification of the species represented may be attempted. Identification at the genus or species level is usually sufficient to allow the archaeologist to make a considerable number of inferences about the culture with which he is concerned. The problems of identification are lessened by a knowledge of the fauna occurring at the site in the present. Barring marked faunal changes in recent times, the modern species may be taken as representative of those occurring in the area during occupation of the site; this obviously limits the possibilities in identification, making determination of genus, and often of species, comparatively easy. The archaeologist can, therefore, often undertake tentative identification of faunal remains himself, although verification by a zoologist is desirable. If species identification proves too difficult, submission of the materials to analysis by a zoologist is necessary. In any case, however, the archaeologist should attempt to carry the analysis as far as possible, leaving to the expert only those problems which he cannot himself resolve.

In identifying faunal remains, the archaeologist has several aids available for consultation. Among these are printed keys, or descriptions of the salient features of bones of various animals, and comparative collections, which are made up of the major bones of a selected group of animals representing various genera and species. The former are usually restricted to a

FIG. 3. Sample of faunal remains, showing variation in size and fragmentation when every bone is saved. This sample is from Paragonah, Utah, and is mostly deer bone. In samples more fragmented than this identification to species may be possible for only a small percentage of the pieces.

limited area, since inclusion of illustrations and descriptions of skeletal material from a large area is not generally feasible in a printed manual. Comparative collections are usually maintained by museums of zoology or paleontology and often contain materials from all areas of the world.

Printed keys may take many forms, ranging from illustrations of individual forms typical of various genera (Brainerd 1939) to comparatively detailed morphological drawings accompanied by other data (Brown 1952). In these, as in other printed keys, there is a strong emphasis on whole specimens, making identification of fragments rather difficult. The printed key is thus of limited value to the archaeologist, who must of necessity deal primarily with fragmentary specimens (for examples of the degree of fragmentation commonly encountered, see Fig. 3). In any case, comparison of faunal remains with illustrations of similar material presents a number of problems which tend to make identification rather tenuous; lack of a 3-dimensional effect, difference of scale, failure to illustrate all aspects of the bones, simplification of details, and failure to illustrate individual variation in age and sex, all combine to increase the possibility of error, as well as the amount of effort required. If preliminary identification is to be attempted in the field, however, a printed key may be of value because of its portability, although final analyses should not rest upon this type of comparison.

The use of a comparative collection offers several advantages, principally the direct comparison of faunal remains with bones of similar species. Here problems arising from use of a printed key are overcome, since the comparative collection may contain bones of juvenile and adult males and females of each species, and

knowledge of the critical features employed in identification may allow rapid and accurate determination of genus and sometimes of species. Comparisons of articulations and shaft sections are not difficult, and if the study collection is at all complete few unidentifiable forms should be encountered. Apart from collections assembled by zoologists and paleontologists, a workable collection may be developed from faunal remains recovered during excavation of several sites in a given area. In making a collection of this type, the relative importance of various bones should be considered; generally the skull, pelvis, and limb bones are desirable, although any one of these may be used alone. Extensive excavation within a given region allows ample opportunity for development of a study collection from faunal remains, although in some cases contemporary specimens may be substituted. A collection of this type may allow fairly accurate species identification both in the field and in the laboratory, although checking by a zoologist is advisable, particularly when changes in fauna through time are suspected.

Following species identification, tabulation of each species may be undertaken. The most effective method for determining the number of individuals represented is that described by White (1952: 337; 1953a: 396-7), which involves separation of right and left components, using either one bone, such as the femur, or all of the large bones of the animal. The greater number is used as the unit of calculation in determining the total number of individuals. The figure thus derived may not be extremely precise, and an arbitrary correction factor may be applied to account for those individuals whose remains have not been preserved. A significant example of the results obtainable from a count of individuals is given by Clark (1957: 10) for the Mesolithic site of Star Carr.

Analysis of the age of individuals represented may also be attempted. Neither printed keys nor study collections are essential here, for the same criteria obtain for all species. Here, as in species identification, the pelves, limb bones, and teeth are most important; while it is desirable to use as many of these as possible, determination of age may be made using any one alone. The degree of closure or obliteration of the epiphyses of the bones and eruption of teeth are most significant, although age may be roughly determined from the over-all size of the bones. Aging for archaeological purposes presents no real problems, and should be attempted whenever possible, since a number of inferences can be drawn from such data.

Faunal remains may also provide considerable data on butchering techniques, both at the concrete and inferential level. Here there is no uniformity in the factors to be considered; bones should be examined for breaks or cuts which may indicate use of specific tools or techniques in butchering of game (White 1952: 337; 1953: 163). Aside from this, there are no specific features which can be analyzed; the majority of the inferences concerning butchering techniques are based upon comparison of archaeological data with data on relevant ethnographic groups, a problem discussed more fully below.

Interpretation of the data derived from the above described techniques allows the archaeologist greater insight into not only hunting techniques and patterns, but also season of occupation and such facets of nonmaterial culture as technological or cultural level and social organization.

Perhaps the most obvious interpretations which can be drawn from analysis of faunal remains are concerned with hunting patterns, since it is the food-gathering patterns and techniques which the animal bones in a site most clearly reflect. A primary feature of the hunting pattern which comes to light in species tabulation is preference for certain of the animal food resources of a given area and accompanying neglect of others, a phenomenon noted by White (1952: 337) among Plains groups, by Taylor (1948: 186) in Coahuila, by Dart (1956: 40) at Makapansgat, and by numerous others. The occurrence of preferred species may indicate lack of recognition of the potentialities of certain animals, or it may be viewed as a result of cultural conditioning.

Significant inferences concerning the area hunted by the occupants of a given site may also be made on the basis of the occurrence of remains of species not native to the immediate area. Thus Meighan (1955b: 25) is able to infer travel of inland people to the coast to gather fish, in addition to hunting in interior valleys, from the presence in a California cave site of remains of both coastal and inland fauna. Neil (1956: 386) and Fowler and Winters (1956: 50) make similar inferences for sites in the southeastern United States.

Changes in economy may also be inferred from faunal remains. Here, analysis of frequen-

cies of various forms in upper and lower levels of a site may reveal alterations in the ecological orientation of the occupants. Wheat (1955: 157) suggests either climatic or cultural change in Mogollon sites on the basis of the appearance of the turkey and muskrat in early levels, while Movius (1954: 312) discerns a shift from horse to reindeer as the main food source in the Upper Palaeolithic of France. This type of analysis is often based upon differences in genus or species, although in many cases the change in economy involves a complete shift from one major food resource to another. If such changes are of sufficient magnitude, alterations in technology and accompanying shifts in social organization may be inferred with some degree of certainty. If sufficient length of time is involved, reconstruction of the environment during occupation of a site, such as that suggested by Gauthier (1956: 80) for the rock shelter of La Colombière in France, may be attempted on the basis of differences between contemporary fauna and remains from the site.

Butchering patterns, although they may sometimes be inferred from cuts or breaks on the bones themselves, are more often suggested by the absence in a site of certain bones of a given species. White (1954) has carried out a considerable amount of work in this direction in the Plains area, basing inferences upon relative frequencies of various bones of the bison. These inferences are correlated with ethnographic data, and in many cases specific techniques or patterns are suggested.

Season of occupation may also be inferred through analysis of faunal remains; more than any other, this level of inference offers a variety of data upon which ecological and cultural interpretations can be based. Mammal, bird, and fish bone may all be used in reconstructing patterns of seasonal occupation and migration. Reconstructions of this type are of value both in explaining the presence or absence of various cultural items in a site and in indicating the possibility of locating, in other areas, similar sites occupied at other seasons. Indication of year-round occupation is also of importance, since this will suggest certain ecological and cultural orientations not present among migratory groups.

Inferences concerning season of occupation based on analysis of mammal bone are concerned primarily with presence or absence of remains of juvenile individuals in the site material. Since the occupants will have hunted juveniles as well as adults, lack of bones of immature individuals is indicative of hunting during seasons when only adult animals were available. Particularly in the case of larger mammals, seasonal hunting seems unlikely, and seasonal occupation appears to be a better explanation of the lack of bones of juvenile individuals. Baumhoff (1955: 64) infers occupation of a California cave site only during winter and spring from the absence of bones of juvenile deer; certainly in this case such an inference is justified, since deer formed one of the main items of diet, and seasonal hunting is highly improbable. Clark (1952: 26) arrives at the reverse conclusion for caves in southern Germany on the basis of the occurrence of bones of foetal reindeer. Year-round occupation may also be indicated by the presence of both juveniles and adults.

Analysis of bird bone may also show season of occupation; here the interpretations are based upon knowledge of the species present in a given area during various seasons. Howard (1929: 380-3) suggests year-round occupation for one California shellmound on the basis of the presence in the site of bones of both summer and winter visitors, while McGeein and Mueller (1955: 59) infer fall and winter occupation of a nearby site from the markedly higher percentage of remains of winter birds noted in the faunal remains. Inferences of this type, while they rest on fairly solid ground, may be subject to error, since presence in a site of seasonal species does not necessarily rule out year-round occupation. Higher frequencies of seasonal visitors may indicate merely food preferences, or may be due to dependence upon other sources of food during part of the year. However, in most cases the archaeologist is justified in suggesting seasonal occupation if these possibilities are taken into account.

As with mammal bone, the presence of bones of juvenile birds may be taken as indicative of occupation during the growth period of the species in question; this is useful primarily in substantiating inferences based upon analysis of bones of adult birds, since the young generally remain with the parents for some time after birth. Clark (1952) suggests that the period of occupation of a site in Germany included the summer months because of the presence in the site of bones of summer visitors and immature individuals. Year-round occupation may also be inferred from the presence of both summer and winter visitors; here the archaeologist is on

firmer ground than when dealing with seasonal occupation, since, as with mammal bone, conclusions based upon the presence of remains are less subject to error than those based upon negative evidence.

Fish bone, like mammal and bird bone, may be a significant indicator of season of occupation. Here too the presence in the site of remains of seasonal species indicates occupation of the site during a given season; thus Clark (1952) is able to infer summer occupation of caves in France on the basis of the presence of remains of salmon. Year-round occupation may also be inferred from the presence of both summer and winter species. Here again cultural preference or differential preservation may distort the species count, but nevertheless fish bone, despite its scarcity in many sites, should be considered as a valuable indicator of season of occupation.

Antler may also provide data on season of occupation; analysis is based upon whether the antlers are shed or broken out, a fact which is sometimes difficult to ascertain. In general, shed antlers are characterized by a small, thin flange of bone at the base, a feature usually lacking in broken out antlers. The difficulty in separating the 2 types of antlers lies in the fragility of the flange, which is often obliterated on shed antlers. If preservation is good, however, a fair number of antlers from a given site should admit identification. With the knowledge that artiodactyls shed antlers in winter, growing a new set during spring and summer, the archaeologist should be able to determine with a fair degree of certainty the season of occupation. Clark (1952: 26) uses these criteria to define the season of occupation of certain sites in France and Germany.

Of primary importance in the definition of season of occupation is analysis of various classes of material. Thus, while the bird bone from a site may indicate seasonal occupation, the mammal bone may indicate year-round occupation (Clark 1952: 38). Due to differential preservation, cultural preference, or accidents of sampling, certain species may not appear, giving the impression that seasonal occupation was practiced. Analysis of the different classes of faunal remains generally tends to offset the various factors leading to error, however, so that the archaeologist who examines all faunal remains is usually able to present reliable conclusions.

Aside from direct ecological interpretations, analysis of faunal remains offers ample opportunity for inference bearing on the cultural level of the group under study. While such inferences may be based upon technological materials alone, some facets of the culture pattern may be clarified or amplified through consideration of faunal remains. Faunal remains do not in themselves usually offer any concrete data which may be applied to interpretations concerning material culture, but they nevertheless suggest a number of areas for consideration, of which only representative samples will be discussed here.

The occurrence in a site of remains of large mammals may be indicative of a certain level of technological or cultural development. Mammals too large to be killed, butchered, and transported by one individual must be hunted by groups of men, probably under some sort of informal leadership. Remains of such mammals in a site may be taken as suggestive of the existence of some type of loose organization for hunting, and perhaps for other purposes as well. This is a facet of culture which cannot always be inferred from the artifact assemblage alone, so that analysis of faunal remains operates here to provide a clearer insight into the cultural pattern within which the material objects were employed. This type of analysis may also indicate the use to which various items of material culture were put; particularly in the case of the simpler, less diagnostic tools and weapons, knowledge of the ecological adaptation of the group may serve to suggest uses not readily apparent, allowing the archaeologist to reconstruct more fully the life of the group with which he is concerned.

Analysis of fish bone, like mammal bone, may shed light on various aspects of nonmaterial culture as well as certain phases of material culture. While in most areas the remains recovered are those of fresh water or coastal species, in some cases, notably the Canaliño complex of southern California, remains of deep-water species are present. From the existence of these remains it is possible to postulate use of boats and deep sea fishing equipment, although the vessels and implements themselves may not be preserved. Some suggestion of the cultural level accompanying this type of economy may also be gained from analysis at this level.

Mammal, bird, and fish remains may also suggest the existence of certain perishable elements

of material culture, primarily traps, snares, and nets. Knowledge of the methods employed by modern primitive groups in capturing similar species may allow the archaeologist to postulate use of similar methods and apparatus by the occupants of a prehistoric site. Thus Clark (1952) infers use by Magdalenian groups of snares under snow cover in catching arctic grouse on the basis of observed habits of the birds and use of this method by modern Lapps. The occurrence in a site of any species which is customarily caught in one type of trap or snare by modern primitive groups may suggest use of similar trapping methods by prehistoric peoples. Remains of fish inhabiting stream or ocean bottoms may similarly suggest use of distinctive seins or fishing gear which may not be preserved. Breaks or punctures in bones may likewise indicate use of certain weapons in hunting (Lindner 1950, Pl. 5), although evidence for this type of inference is rare.

In analyzing faunal remains, it is important to recognize that the bones may represent functional material rather than food remains. Clark (1952: 38-9) notes that eagles may be trapped for feathers, and birds for their beaks for use as hunting talismans, and White (1954: 258) suggests that the preponderance of certain bones of bison in Plains sites is due to their use as tools. Most functional bone is taken from food animals, however, so that occurrence of this type of material in a site should not distort species counts.

Apart from the types of inference discussed above, considerable data may be derived from analysis of faunal remains in terms of diet and protein intake. These types of inference, since they depend upon quantitative analysis of material gathered in controlled samples, were discussed in the preceding section on midden analysis.

Faunal Remains: Shell

Shells represent one of the most important midden components for interpreting ecological conditions. Since the hard shells of mollusks are usually preserved, they often offer more abundant information than do animal or plant remains. It is possible to make rather positive interpretations concerning the conditions which prevailed when the mollusks lived, through knowledge of the present habitat requirements of the species. Shellfish are also good indicators of general climatic conditions, reflecting changes in ocean temperatures quite precisely. Inferences concerning shellfish can also be made with regard to diet and food resources, as well as various cultural elements, including economic change and food preferences.

There are 2 distinct methods of obtaining specimens from the field: field sampling and column sampling. The first method includes both surface sampling and collection of material by level in an excavated site (for illustrations of the amount of shell present in typical California coastal shellmounds, see Figs. 4 and 5). The former technique involves collection of specimens from the surface of a site, usually within a designated area, while the latter involves sampling levels of a site during excavation, with identifiable specimens of various species being taken from each level and placed in marked bags.

Field sampling differs from column sampling in that it does not produce reliable quantitative data, although it may provide a representative species sample. In most cases field samples will give a false impression of the percentages of the various shell components, due not only to the selective bias of the collector but also to the fact that usually only whole shells are retained, small pieces being overlooked. If quantitative analysis of such a sample is attempted, the results may be the reverse of the actual situation. However, although it is selective, a field sample is useful in providing a complete list of species, since some of the rarer shells may not appear in column samples.

The column sampling method gives quantitative results, and a truer picture of actual relationships within the site. (In the following section on interpretation the majority of the examples cited were obtained from studies employing quantitative midden analysis.) The technique of removing a column sample was discussed in the preceding section on midden analysis.

In the laboratory, the shell in the field samples is carefully washed, with special attention being given to the hinge area, since this is important in identification. The material from the level bags can then be cataloged in lots. Laboratory treatment of column samples has been discussed above.

The shells should be identified to species if possible. This can be accomplished with the aid of a good shell key and a comparative collection. A comparative collection can be assem-

bled without great difficulty by obtaining a list of existing species for a given region and then collecting specimens during surveys and site excavations. There are numerous excellent published keys to shell species which are quite helpful in identification. The following are cited only as examples of keys which are easy to use because they permit rapid and accurate identification; similar keys for other areas can be obtained (see Morris 1947, 1952; Fitch 1953; Hill 1954; McLean 1951). If problems in identification arise, it will be necessary to consult a conchologist. The specimens should be carefully washed, sorted, and identified as thoroughly as possible, so that only verification or addition of some species names will be required from the specialist. For illustrations of sorted shell components, see Figures 6, 7, and 8.

The most obvious interpretation which can be based on analysis of shell concerns the kind and quantity of shellfish used in the diet of the inhabitants of a given site. Variations in the types of mollusks which appear in different levels of a midden may in some cases indicate a depletion of one source and use of another (Gifford 1916; Neil 1956: 392). Morrison (1942: 367) cites a decrease in the amount of mussels used and an accompanying increase in the amount of snails as indicating that these 2 sources of food were used to supplement each other, at least in times of scarcity. Problems such as the amount of protein intake from shellfish require a more specialized type of quantitative analysis, and have been dealt with in the section on midden analysis.

Aside from inferences concerning food resources, there are a number of cultural interpretations which may be based upon shell analysis. One of the most notable of these is the indication of cultural preference for certain types of shellfish. For example, the earlier cultures on the southern California coast used rock-dwell-

Fig. 4. Texture of shell midden near Oxnard, California. This site is a little less than 20% shell, by weight, in the portion pictured. Arrow is 6 inches long.

ing mollusca, while later cultures preferred the sand-dwelling Pismo clam (Peck 1955: 57-60). The earlier cultures appear not to have used the Pismo clam in any quantity, although it was available. Morrison (1942: 353) checked the species list for the Tennessee River Valley area and found that certain deep water species were not present in the shellmounds. He inferred that the Indians gathered only the beach and shallow water shellfish, and did not collect deep water forms. Related to this is the question of technological level. It is possible that a particular species of mollusk, although present in the environment, may not be utilized because of a lack of adequate collecting implements. For instance, the geoduck (*Panope generosa*), the largest species of bivalve found on the west coast of North America, is found buried in about 4 feet of sand. The aboriginal Indians of the California coast did not have tools which would make this clam accessible for food; it can only be dug today with a great deal of effort, using specialized equipment. Consequently, the geoduck is not found in any shell middens, although the Lower Chinook Indians, using a specialized type of digging stick, were able to obtain this particular clam (Greengo 1951: 3).

In addition, interpretations can be made regarding food preparation techniques. In discussing the shellmounds of the Tennessee River Valley, Morrison (1942: 381) suggests the possibility that snails were steamed in a pit beneath the fire, since very few of the shells were firemarked, indicating that they were not roasted over the fire. After steaming, the snail was removed without breaking the shell. Morrison also infers that mussels were steamed open by being placed over hot rocks, basing his inference on the large amount of water-cracked rock fragments present in the mounds.

From the appearance and abundance of shell in certain levels of a midden, one can infer the

FIG. 5. Texture of shell midden at Little Harbor, Catalina Island. Profile is 30 inches high; lower levels are almost 60% shell, by weight. Compare with Figure 4.

development of a maritime economy, as King (1950) does for the Northwest Coast. The same maritime shift in economy occurs in the cultures of the southern California coast, in which there appears to be a progressive emphasis on ocean fishing, shellfish, and sea mammals. A similar change is shown in the Mesolithic in Europe, where the Maglemosean people developed a maritime economy in response to changing ecological conditions (Childe 1937: 240). Rouse (1951: 249) has suggested the possibility of population movements in response to fluctuations in sea level and available food supply. In his Florida study he infers a shift in population as a result of a rise in sea level leading to flooding of Indian River and an accompanying influx of marine shellfish which became available as a food resource for the first time. The Indians presumably responded to this by moving to the river to take advantage of the new food source.

Interpretations concerning season of occupation are usually based upon analysis of bird and animal bones. However, Morrison (1942: 380) infers from the presence of a complete land

FIG. 6. Samples of abalone shell from shell midden, sorted to different sizes. Smallest size is material caught by ⅛-inch screen. Note that even small pieces are identifiable with some certainty from their color, sheen, texture, and the way in which shell breaks up.

FIG. 7. Samples of mussel shell, sorted as in Figure 6.

snail fauna that Tennessee Valley sites were "... seasonally or otherwise intermittently inhabited." Since the land snails are assumed to have lived on the mound, it is suggested that some time passed between periods of occupation, allowing the snails to live on the site.

The shell species in a site may in themselves reflect changes in the environment; however, with an indicated change in climate, it is possible to infer correlated ecological conditions, such as the past existence of lakes and trees (Gebhard 1949: 135). In the central California area, the presence of a shell found only on driftwood in salt marshes suggests the existence of a salt marsh and a supply of firewood near a site, although neither is present today (Gifford 1916: 9). A change in sea level is also reflected in the shell species found. Silting in of portions of a bay helps explain the predominance of clam over rock dwelling species, such as oyster and mussel (Greengo 1951: 16). Likewise, a change in species reflects the filling in and drying up of a lagoon at a site in Panama (Greengo 1954: 146).

Certain marine shell species are sensitive indicators of slight changes in water temperature, shifting their habitat in response to such changes (Hubbs 1948: 479). Along the Pacific Coast near San Diego, one species of abalone (*Haliotis rufescens*) occurs only in the cooler infratidal waters; however, it reappears between tides in Baja California. The reason for this is that in areas of upwelling along the coast the inshore temperatures may be lower than at points on the coast farther north. Therefore, this abalone, a cool water species, again appears farther to the south in the areas of upwelling (Hubbs 1948: 460). Further research into problems of this sort would enable the archaeologist to use shell species from sites as valuable indicators of climate and correlated ecological conditions.

PLANT REMAINS

Plant remains are less often encountered during excavation due to their perishable nature. However, when plant remains can be obtained much valuable ecological information may be derived from them.

Dendrochronological and palynological techniques have been omitted here because they are used primarily for chronological interpretation. These approaches may also be used for reconstruction of past environments, as mentioned below. Faegri and Iversen (1950) give

information on palynological technique, and Glock (1937) discusses dendrochronological techniques. See also Anderson (1955) and Cain (1939). Consideration of domesticated plants has been omitted here since this paper deals only with hunting-gathering cultures.

There are no specialized techniques for excavating plant materials, other than care in handling fragile specimens. They are most commonly found in dry cave deposits. The fibrous nature of certain abundant plants may make column sampling impractical. If seeds are encountered, they may be put into glass vials and preserved in 70% denatured alcohol (Barghoorn 1944: 291), while wet wood remains should be kept wet or slowly dried in the field.

It may be useful to obtain specimens of plants from the region being excavated, particularly blossoms and fruits. These are valuable for identification of site species and also for determining possible plant changes through time. Botanical specimens can be preserved in the field with a portable press. This can be easily improvised; all that is needed is 2 fairly large rigid surfaces which can be clamped or compressed together. Specimens are placed in a folder (newspaper is satisfactory) and pressed between 2 boards. Care should be taken not to overlap or fold specimens. Twigs should be flattened and spread out; cotton can be used to prevent crushing of bulky organs. The folder may be interlaid with a drier, made of fine absorbent material such as felt, and a ventilator of corrugated cardboard. Care should be taken to prevent excessive dampness, which can cause mildew. For a detailed account see Pool (1929: 322-37).

Identification of wood specimens can often

FIG. 8. Samples of pecten shell, sorted as in Figure 6.

be accomplished by microscopic examination. Transverse, radial, and tangential sections should be prepared. Sudworth and Mell (1911) identify oak types by examining tracheae, tracheids, wood fibers, wood-parenchyma fibers, and pith-ray cells. Identification of plant remains may be made through analysis of epidermal cell structure, vascular fiber bundles, individual fiber form, and microchemical reactions (Bell and King 1944: 150-60). If charcoal is obtained, it may be necessary to bleach it for identification of species. This may be done by subjecting the material to alternate prolonged treatments with strong chlorine water and a dilute aqueous solution of caustic soda (Barghoorn 1944: 293).

A field of study which has been largely ignored by archaeologists is fecal analysis. The few published discussions of fecal remains are extremely cursory (Loud and Harrington 1929: 35; Meighan 1953: 203). Since fecal specimens offer direct evidence of diet, greater attention to such material could yield important ecological information. Feces found in the site should be carefully packed and kept dry. Dietary analysis of fecal remains has been attempted by zoologists; Kelker (1937) calculated the insect diet of the skunk during various seasons by quantitative analysis of fecal material. The following is a suggested line of procedure for fecal analysis: Fecal remains should first be macroscopically examined. Animal identification is based on form and size (Murie 1954). The remains can then be soaked, stirred, and rinsed over fine mesh. The residue can be examined microscopically for identification of undigested food particles (Gradwohl 1948: 1104-5). A quantitative value for plant material may be determined chemically. A process for chemical analysis of cellulose content in feces is also known (Anonymous 1904).

Several important lines of interpretation can be followed in analyzing plant remains. Past environments can be reconstructed; dendrochronology (Douglass 1939) and palynology (Faegri and Iversen 1950) are best suited to investigation along these lines. Inference regarding seasonal activities of the inhabitants of a site can be made. This can be done by noting cambrial activity. Bailey and Barghoorn (1942: 84) deduce that stakes used in construction of the Boylston Street Fish Weir were cut some time between mid-April and mid-June. This type of inference can also be made by noting the relationships of various seed/fruit bearing periods. Taylor (1948: 189) points out that food storage would be indicated if piñon nuts and maguey stalks were found in association, since their seasons of maturation differ. Fecal specimens can also be used to determine whether a site was occupied seasonally; if feces containing only seasonal vegetation are encountered, the site was occupied only at the time when these food resources were present (Taylor 1948: 185).

The use of certain plants for food can be determined by the presence of edible plant remains in a site. Ethnographic confirmation of their use as food may also be available. Clark (1952: 90) deduces that the inhabitants of the late Neolithic site at Orkney included the seaweed *Ascophyllum nodosum* in their diet since it was encountered during excavation and is mentioned as a food source in ethnographic accounts. Fecal remains are invaluable for interpretation of food resources since positive proof of ingestion is provided, and use of plant foods is clearly demonstrated. Fecal remains, in conjunction with midden analysis, supply the archaeologist with data on omnivorous dietary patterns.

Cultural selection of plant materials for artifact manufacture can also be inferred in some cases. Bailey and Barghoorn (1942) were able to determine the types of timber selected for construction of the Boylston Street Fish Weir by microscopic examination of wood remains.

From the above discussion it can be seen that, despite their rarity in midden sites, plant remains must be considered an important source of ecological data.

PETROGLYPHS

Petroglyphs (here including both rock carvings and paintings) are an additional source of ecological information, since they often picture food resources and hunting-gathering activities. Petroglyphs are, of course, of cultural origin and hence different from the floral and faunal remains previously discussed. However, since petroglyphs are intimately linked to the geographical environment and not ordinarily a part of individual site records, they may be briefly mentioned as an additional line of ecological investigation. Ecological interpretations are often made from artifacts (projectile points, harpoons, and the like), but since the interpretation of arti-

facts is a standard part of archaeological method we will not further consider this approach.

The interpretation of petroglyphs is best demonstrated in Europe, where many Paleolithic and Mesolithic sites contain rock paintings and engravings of a realistic nature. In fact, many pictures are so accurately drawn that animals can be identified as to individual species. Obermaier (1924: 232) lists the following animals depicted in the Franco-Cantabrian caves: mammoth and elephant, wooly rhinoceros, cave lion, bear, wild horses of various types, wild ass, wild ox and bison, stag, hind, Dama deer, reindeer, ibex, chamois, wild boar, wolf, and various birds, fish, and snakes. Inferences concerning food resources and hunting and gathering techniques have been made, and, where possible, correlated with faunal remains. Clark (1952: 33) refers to a hunting scene from a petroglyph from eastern Spain which depicts a herd of deer being driven into a line of bowmen. Also from this area is the well-known painting of a woman gathering wild honey, illustrating the use of this food resource in the Upper Paleolithic (Clark 1952: 34). From Castellon, Spain, a hunter is pictured following animal tracks, which are recognizable as the hoof imprints of an artiodactyl (Obermaier 1924: 249). And at Malaga, southeastern Spain, there are representations of animal tracks inside of enclosures which seem to be traps of some kind (Obermaier 1924). In the Camonica Valley in Italy there are representations of hunting scenes complete with dogs chasing deer and men on horseback following them. Pile dwellings with gable roofs are also shown (Frobenius and Fox 1937: 32).

Petroglyphs from Southern Rhodesia consist mainly of landscape scenes with trees, plants, and lakes containing fish (Frobenius and Fox 1937: 48). Southwest Africa is noted for many excellent petroglyphs of clothed human figures and numerous animals. Here, as in Europe, individual species of animals can be identified. Breuil (1955) lists the following animals depicted in petroglyphs: ostrich, giraffe, elephant, buffalo, hartebeest, gemsbok, rhinoceros, eland, cheetah, antelope, and oryx. Weapons such as the lance and bow are represented, as are waterskins of various shapes. The latter suggests that there was already a scarcity of water in the region (Breuil 1955: 14).

The Scandinavian Stone Age produced many petroglyphs of a realistic nature in which are depicted men, animals, and boats. Frobenius and Fox (1937: 31) believe this indicates that the makers of the petroglyphs were hunters and fishermen practicing the historic Scandinavian drive-hunt, which consists of driving animals over a cliff into the water where men are waiting to dispatch them. Clark (1952) also refers to rock engravings in southern Sweden showing men line-fishing from a boat, and on the coast of western Norway Stone Age engravings depict boats and many representations of whales and porpoises, as well as elk, reindeer, bear, water birds, halibut, and seal. This illustrates not only the variety of animals, birds, and fish which formed the bulk of the diet, but also suggests that ". . . porpoises, killer whales, and pilot whales were hunted on the Norwegian coast already during the Stone Age (Frobenius and Fox 1937: 68).

A more exhaustive study of the finer details of some of the European Paleolithic and Mesolithic petroglyphs by Lindner (1950) illustrates further inferences concerning specialized hunting techniques. He has deduced the use of nets, palisades and ditches, pit traps, deadfalls, lassos, and corrals, as well as the use of the bow and arrow and the dog. One tectiform drawing he interprets as a trap, while the same one is suggested as a depiction of a summer hut by Clark (1947: 160). Of course, it must be kept in mind that interpretations from petroglyphs of this nature may be more suggestive than convincing because of the simplicity in execution.

There has been very little ecological interpretation of New World petroglyphs, due mainly to the fact that most of them are not realistic. Most reports deal with element distributions (Steward 1929), or symbolic interpretations. Mallery (1893), in a very exhaustive study of American rock paintings and engravings, does include in a few instances some ecological interpretation. Near Visalia, California, a petroglyph is reported which depicts deer, antelope, coyote, birds, and turtles; these are described as animals possibly slain in the hunt (Mallery 1893: 52). Another example from the same source (p. 124) describes a group of rock paintings in West Virginia depicting numerous animals thought to represent the kinds of game abounding in the region. In comparisons with petroglyphs found in other parts of the world, Mallery cites some examples which are accompanied by attempts at ecological interpretation. One example from New Zealand describes some representations of fish, whales, and moas. The

moa is associated with several tectiform drawings, one being an adzlike weapon, with which the bird might possibly have been killed. Another form, resembling a post with 2 branches on top, may represent some means by which the moas were caught, or else indicate that this type of bird lived in open country between the forested areas (Mallery 1893: 165).

These few examples will serve to illustrate the possibility of using petroglyphs as an additional source of information of an ecological nature.

Inorganic Remains

During site excavation, not only artifacts and organic remains but also inorganic, nonartifactual materials should be collected. Column sampling can be used if the remains are abundant and fragmented. In this paper we are concerned with adaptation to the environment for survival; therefore materials selected for ornamental or luxury purposes will not be discussed.

A reconnaissance should be made of the site areas to determine inorganic resources. Specimens may be obtained of all materials which might be used for artifact manufacture, including rock from quarries and other sources, clay, if pottery is made in the area, and in certain cases, such as the Old Copper culture (Wittry and Ritzenthaler 1956), ores and minerals.

Ecological information can best be derived from inorganic materials if they are subjected to quantitative analysis. Archaeologists have made quantitative analyses of pottery (Shepard 1936, 1956), but primarily to obtain technological, not ecological, information. Studies of stone artifact materials are usually general and include a number of rocks and minerals (Holmes 1919; Heizer and Treganza 1944). Witthoft (1952) has studied variations of the same materials, while Boyer and Robinson (1956) have applied similar techniques to demonstrate that extensive trade took place in northwestern New Mexico by the wide dispersal of Jemez Mountain obsidian in that area. These same authors have made use of qualitative examination of obsidian by determination of indices of refraction of powdered material.

By determining exact sources of supply of manufacturing materials it is possible to make certain ecological inferences. From the presence or absence of indigenous materials in a site one can infer cultural selection. At the Folsom site in northeastern New Mexico, local obsidian was not used; instead "Alibates flint," or dolomite, obtained from the quarries north of Amarillo, at least 150 miles away, was used. This would suggest a cultural bias against the use of obsidian by Folsom artificers (Krieger 1954: 275). If manufacturing materials not indigenous to a region are found in a site, trade or migration can be inferred. Witthoft (1952: 470-3, 493-4) infers that the producers of the Enterlene industry migrated from the north, since New York chert varieties are present in the Enterlene assemblage. It will be seen that in this and other areas analysis of inorganic materials plays an important role in providing ecological data.

Conclusions for Part I

Nearly all of our examples involve human choice—selection of one possibility from a range of possibilities. No group is so poverty-stricken or limited by its environment that it has no choices. All hunter-gatherer groups select such things as the location of their village, the food resources to sustain them, and the raw materials necessary to their technology. It appears, therefore, that real understanding of prehistoric man's relationship to nature must take into consideration his choices of alternatives. It is important to know what he had available and did *not* take. Hence, the identification of the environmental setting for a prehistoric culture is of the utmost significance, particularly where the environment has changed since occupation by the prehistoric group.

A second conclusion is that the technology of peoples may be relatively constant while their ecological adaptations can be very diverse. That is, even the primitive technology of the hunter-gatherer groups provides enough control over nature so that a great variety of resources can be exploited. It appears, therefore, that the reconstruction of culture history from artifacts can provide only the broadest outlines of the picture. Culture stages, denoted by such terms as "Archaic," have been defined too loosely by emphasizing artifact inventories. The variety of "Archaic" or "Hunting-gathering" cultures is much greater than can be perceived through tabulation and comparison of artifacts. To understand such cultures in detail, one must go beyond the technology to seek various kinds of ecological information. Two examples may be mentioned. The discovery of leaching might open up a tremendous food resource to a cul-

ture, yet the invention need not be reflected in the technology at all in the form of new types of artifacts. Similarly, the discovery that shellfish could be dug out of the sand, as well as pulled from the rocks, might double the available food supply in a region. Again, no change in the technology need be made.

It should also be noted that the degree of efficiency with which tools are used is not often reflected in the artifacts themselves. The arrowheads from a site do not reveal whether the makers were expert or indifferent marksmen. The nature of the faunal remains in the site, however, might afford a basis for comparison with other sites of similar technology.

In sum, of the many new directions taken by archaeological research in recent years, the greater attention to definition and interpretation of ecological factors seems a most promising step. Such studies open the door to new interpretations and greater understanding of culture history.

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A TYPOLOGICAL ANALYSIS OF AXES AND CHOPPERS FROM SOUTHEAST AUSTRALIA*

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THREE major factors have influenced the classification of stone artifacts in Australia. The first is the presence in the country of a contemporary stone-using people, the Australian aborigines. Early, relatively complete, and ethnologically valid studies of their life (Spencer and Gillen 1899), have given Australian artifact studies a functional flavor; so much so, that descriptive classifications have been proposed, whose major categories were in completely functional terms (Kenyon and Stirling 1900). Quite properly, Australian workers have sought functional comparisons between implements in current use and those whose function could not be discovered by ethnological enquiry, either because their makers had become culturally disintegrated, as in southeast Australia, or because their function was unknown to the living aborigines in the area concerned (see, for instance, the discussion of the mounted elouera in Setzler and McCarthy 1950). There has been no attempt to separate clearly in classification those artifacts whose function and reality as an entity have been established by ethnological enquiry, including the ability of the aborigines to name the implement concerned, and those whose reality could not be so established.

Secondly, considerable confusion has been created in Australia by the occurrence of many artifacts similar to those of the classical industries of Europe, on surface sites in different parts of Australia and on single sites. There has been, too, an ahistorical outlook paralleling the mid-Victorian English view of the history of man, reinforced by the lack of any properly conducted archaeological excavations prior to that of Hale and Tindale (1930).

Thirdly, there has been an emphasis upon material as a determinant of form and technique, rather than as a codeterminant with these of a final type. Together with the former ahistorical tenor of artifact studies, this has obscured archaeological process, tended to tie description to local classes of objects, and prevented the analysis of the differentiation of traditions in relation to local resources.

The lack of any conscious or ecological purposes until recently has also meant that, among some classes of artifacts, and where function could not be pressed into service, recourse has been had to old style, formal characteristics, especially since most collections have been made by laymen, whose motivation was the owning and ordering of a cabinet collection. In general, then, the classifications have grown ad hoc without any relation to archaeological objectives and without the reality of the proposed types being thoroughly established. They are not, as Willey (1953) would put it, "geared to a space-time problem of the second level."

THE CONCEPT OF TYPE AND THE PERCEPTUM

The specific formulation of our problem turns upon the concept of type. The functional emphasis of Australian studies has implied a recognition of types, not only as existent entities, but as entities related to a specific use. The present approach amplifies this view in regarding the type as an assemblage of features perceived by the makers as desirable. This assemblage is called a *perceptum* (plural, *percepta*). Operationally, the perceptum consists of traits and these are what we measure. The ideal would be the use of traits which have been established by ethnological enquiry as being perceived to have value by Australian aborigines. Unfortunately, we do not have a close study of the value systems operating among living aborigines in relation to the manufacture and use of stone implements. The traits used are, in fact, those which are conceived by the archaeologist on general grounds, such as the known manufacturing techniques for axes, to be likely to form part

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EDITOR'S NOTE: This archaeological application of the matrix method of analysis was developed independently, in Australia, at about the same time that Robinson and Brainerd were developing the technique in California (AM. ANTIQ., 1951, Vol. 16, No. 4). Subsequently, Tugby corresponded with Brainerd concerning the method, and made use of Brainerd's method for the recognition of the early end of a sequence.

of a perceptum. In some cases, mere mechanical association of traits may exist, for instance, with "radius" and "shoulder" in the present treatment. The terms used for artifact traits have been defined for the purpose of the present study and it is not pretended that they represent current Australian usage.

OBJECTIVES, PROCEDURE, AND RESULTS

The present study has 2 objectives, first, the empirical testing of the validity of existing types of axes and choppers from southeast Australian which have been established by inspection, and, second, their placement in a space-time framework. The method used is parallel to the Brainerd-Robinson method for chronological ordering of archaeological deposits, although it was developed before the work of these authors was available to the writer (Brainerd 1951; Robinson 1951; Belous 1953).

The sample of axes and choppers was drawn from a collection in the National Museum of Victoria, Melbourne, consisting of 2443 items mainly from the state of Victoria. In the circumstances in which this collection was kept, no more adequate method of sampling from it could be devised than taking one specimen blindly from each box, shelf, drawer, and so on. Unregistered specimens were rejected. The remainder was checked against the catalog, and the region, and, where known, the collector of each specimen noted. Specimens whose place of origin was not given or vaguely given (for example, "E. Australia") were rejected. The following traits were then recorded for the remaining 135 specimens:

1. Maximum *length*, using calipers to nearest millimeter.

2. Maximum *width*, using calipers to nearest millimeter.

3. Maximum *thickness*, using calipers to nearest millimeter.

4. *Weight* in grams to nearest gram.

5. *Shape* in terms of approximation to a series of diagrams.

6. *Cross section* in terms of approximation to a series of diagrams.

7. Manner of treating the *surface* of both sides of the specimen, for example, flaked (scored F), hammered (scored H), original cortex retained (scored C). This trait was then recorded by 2 letters, each representing the situation on one side of the specimen, for example, FC (flaked, cortex-retained). Large flakes whose bulbar surface had undergone no further treatment were recorded as F for that surface. If there was any cortex on a surface of a specimen, that surface was recorded as C.

8. Method of forming the *edge*, recorded by the F, H, and C notation of 7 above, plus P for ground edge. Where cortex was retained on a surface of a specimen but, in forming the edge, that surface had undergone considerable flaking, the area of flaking was recorded by reference to an arbitrary breakdown of the surface into numbered areas.

9. Curvature of the edge by placing the edge against a series of standard curves from which the *radius* of the arc formed by the edge could be read.

10. In edge-ground specimens, the average *extent of grinding* up the side.

11. *Shoulder*, that is, rounding of the corners of the specimen adjacent to the edge, by reference to 5 standard diagrams.

12. Use of the nonedged end of the specimen as a *hammer*.

13. Presence of a hafting *groove* on the body (scored G when present and $\overline{G}$ when absent) or a hafting waist (scored W).

14. Whether the edge was offset like an adz (scored A, *asymmetrical*) or central like an ax (scored S, *symmetrical*).

15. Whether the specimen was made from a *pebble*.

16. Special notes.

The number of times each trait occurred with every other trait was recorded in a matrix (Fig. 1). As a result of preliminary analysis it was decided to omit length, width, thickness, shape, cross section, and weight, which did not form useful sorting criteria; use as a hammer at the nonedged end (a secondary feature); shoulder, which was a function of radius; and distance of grinding up the side, which could not add any refinement to the sort beyond that implicit in edge PP.

Radius, which ranged from 1 to 20 cm., was divided into 3 categories, R1 (1 to 2 cm.), R2 (3 to 5 cm.), and R3 (6 to 20 cm.). Certain combinations of edge (HC, FP, HF, and PH) and of surface (FH) occurred in very small numbers and were dropped, thus reducing the number of traits to 19. The sorting of the 19 by 19 matrix was carried out with a Hammond Matrix Sorter, an apparatus similar to that used by Belous (1953) and to be regarded as indispensable equipment for this kind of work. What is regarded as the best sort was determined by inspection.

Results

The matrix analysis demonstrated the possible existence of 2 major percepta combining the following traits respectively:

B. Asymmetry of edge (A); cortex-flaked edge (edge CF); double cortex surface (surface CC); intermediate edge radius (R2); no groove ($\overline{G}$).

C. Symmetry of edge (S); double ground edge (edge PP); double flaked surface (surface FF); high edge radius (R3).

Three minor percepta are also indicated:

A. Cortex-flaked surface (surface CF); cortex-flaked edge (edge CF); low edge radius (R1); associated with B.

D. Double ground edge (edge PP); double hammered surface (surface HH); associated with C.

E. Double hammered surface (surface HH); grooved (G).

The percepta are linked by traits in common: for instance, A and B by cortex-flaked edge (edge CF), B and C by intermediate radius (R2), C and D by double ground edge (edge PP), and D and E by double hammered surface (surface HH).

The diagram as a whole shows a combination of linear and clumping features.

A double hammered surface (surface HH) may be associated with a double hammered edge (edge HH) or double ground edge (edge PP) and both these types may be grooved. This suggests that double ground edge (edge PP) and groove (G) are separate traditions. Double flaked edge (edge FF) tends to be indifferent and, as might be expected, this trait is ubiquitous.

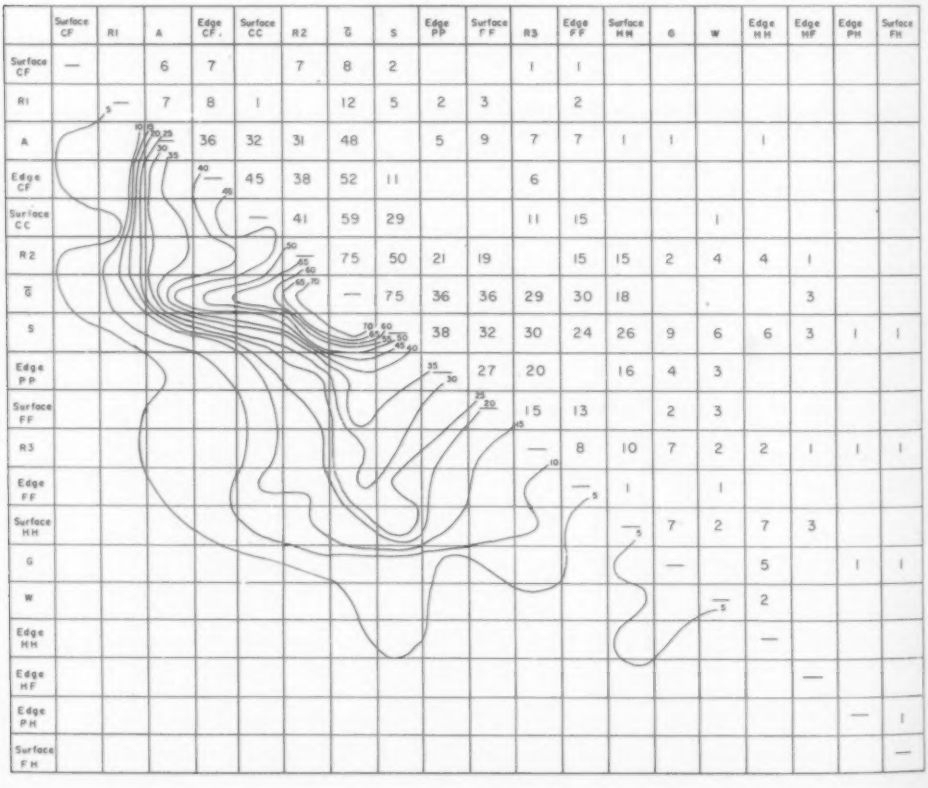

Fig. 1. Sorted matrix of occurrence of each trait with every other trait.

From left to right of Figure 1 there is a succession:

1. From asymmetry to symmetry, indicating a change from an adzlike to an axlike form of edge.

2. From R1 through R2 to R3, indicating an increasingly flattened curve on the cutting edge of the tool.

3. From no groove to grooving and waisting, indicating a possible change in hafting.

4. From a more simple to a more complex perceptum generally, with increase in the estimated amount of work required to produce it.

DISCUSSION

Type and Perceptum. This work is in the nature of an exploratory experiment bearing upon the concept of type and its application in Australian archaeology. Our own usage of the type concept was described above and it remains to show its relation to that of others. Spaulding (1953: 305) defines type as "a group of artifacts exhibiting a consistent assemblage of attributes whose combined properties give a characteristic pattern." Spaulding's concept is essentially similar to our own, except that we do not define the universe from which our artifacts are drawn as a site assemblage as he does later in the same article. Our notion is implicit in Spaulding's statement (1953: 305) that classification is "an operation which must be carried out independently and exhaustively for each cultural context." Now, cultural context is a relative concept which might be applied to a ridge, a site, an area, or a vertical or horizontal segment of a space-time framework. The sample used in this study was, in fact, derived from a number of unstratified sites over a considerable area, a cultural context of a very vague order. In such a case, it would seem that cultural context can only be specified by arbitrary definition of it in a heuristic manner. We agree with Spaulding, however, in excluding Krieger's notion of historical relevance from the definition of our concept of type. Historical relevance emerges pari passu. Like Brainerd's seriation of collections (1951: 304), our seriation of types emerges from the analysis itself.

On the other hand, we differ from Spaulding and from Krieger in drawing attention to the nature of the traits used in defining the type and to the perceptual unity of the whole in the eyes of the artifact maker. In this respect, Krieger's and Spaulding's types are formulated in a more heuristic fashion in relation to historical archaeological analysis than are those of this study, which are culturally and functionally oriented. From this point of view, I am in sympathy with Brainerd, for whom a type is a sorting criterion which "must be of such complexity . . . that the presence of an artifact belonging to it suggests that its maker lived in the same cultural milieu as that of makers of all other artifacts classified into the same sorting group" (1951: 304). The presentation of our interpretation in terms of the perceptions of the individual maker is easily translated into such cultural language via the construct of the perceptum.

Distribution of Traits in the Space-Time Framework. The perceptum in any area is conceived as altering at differential rates through time. A perceptum is linked to a chronologically preceding perceptum by traits in common. Now, if the associations of traits emerging from the matrix analysis are accepted as valid, how do they come about? The most likely answers are that they are a function of regional differences, chronological differences or both.

In order to test the regional differences hypothesis, the areal distribution of the combinations of the traits for surface, edge, groove, and pebble was plotted for the following groups of specimens where it was possible to definitely identify the place of origin: the matrix analysis sample, a similarly derived sample from the Australian Museum in Sydney, and the stated occurrences of axes and choppers at sites described by Mitchell (1949). The 230 plotted occurrences demonstrated the following features: double hammered surface (surface HH) specimens are found throughout Victoria and extending up the Darling River into New South Wales; they are more common in Victoria in the Southern Central and Western Districts; odd double hammered surface specimens occurring on the New South Wales coast are ascribed to trade; both grooved and nongrooved double hammered surface specimens occur, but grooves are rarely found on such specimens which also have double ground edge; numbers of double cortex surface-double ground edge (surface CC-edge PP) specimens occur on the north coast of New South Wales, but they are also mentioned by Mitchell (1949: 153) as being found on the south coast of Victoria; double flaked surface-double ground edge specimens, on the

other hand, are widespread in Victoria, but do not occur on the north coast of New South Wales, where they are replaced, presumably, by the double ground edge pebble (surface CC-edge PP); split pebble specimens are more common on the north coast of New South Wales; edge grinding occurs over almost the whole area in association with different combinations of surfaces; double cortex and cortex-flake surfaces are also widespread, particularly along the coasts and rivers (where pebbles are available). The picture of areal distribution of traits, then, while suggestive, is not clear-cut (nor is it thought that the sample is representative of all areas).

If the effect of trade could be completely accounted for, the regional differences in indigenous techniques might be sharpened. Nevertheless, some traits, and especially edge grinding and the use of flaked edge pebbles, occur widely, if not universally, in southeast Australia. Edge grinding, on the other hand, appears to be adapted to local resources in material. The place of origin of materials is certainly an important factor, but, even if quarries and outcrops are pinned down, we do not know (on present knowledge) whether material was imported and manufacturing carried out according to local traditions or whether complete implements were traded. The critical answer seems to lie in the fact that, in some cases, even though suitable local material is available, a technique may not be used. Moreover, even if trade is invoked heavily to support an hypothesis of underlying regional differences in the face of widespread empirical trait distributions, the differences in the techniques involved must have developed somewhere in some relative order. Further, the spread of the traits through trade must take place through time as well as in space, so that, in any one region, earlier and later assemblages will differ in trait combinations. The alternative to the hypothesis of the appearance of traits in chronological order appears to be to suppose that the original culture included knowledge of the use of all traits and that forgetting and adaptation to local material took place differentially. Although such adaptation undoubtedly plays a part in determining ultimate empirical "types," the fact that material was sometimes obtained from a considerable distance shows that there was often no need for a tradition to die for want of material to practice it upon.

From any point of view, then, there is some advantage in accepting the notion of a perceptum in any one region changing through time under the influence of indigenous evolution or devolution and of diffusion of ideas, possibly in the concrete form of trade goods. Where the perceptum becomes complex and a good deal of labor is involved in tool manufacture, a case might be made out for the likely occurrence of mixed cultures, with the notion of small quantities of "advanced" tool types having a special use occurring alongside "crude" types used for everyday purposes. This is the analog in trait terms of the progressive mixing characterizing sequential archaeological deposits (Brainerd 1951: 311).

Ordering of Percepta. In the present study it is suggested that the percepta should be ordered (A), (B), (C), (D), (E), that is, in the order in which they occur in the matrix. The question remains, which end of the series comes first. Pebble chopper type tools without edge ground tools occur in the material remains of the aboriginal culture of Kangaroo Island, South Australia, which was extinct at white contact. There is no stratigraphic evidence available, however, and, in its absence, one must seek internal evidence in the analysis itself. This is forthcoming by use of a notion analogous to that of Brainerd (1951: 311) for determining the order of archaeological deposits. He noted that in contoured matrices "there is a tendency for the matrix to slope upward toward one end of the diagonal axis rather than parallel to the axis as would be expected, and that concurrently the other end of the axis shows a very sudden rise to high value from low values at edge of the matrix. Graphing of the pottery sequences covered by the collections which formed these matrices, and comparison with stratified material, showed that the four examples were uniform in that the sharply rising end of the ridge is the early end of the sequence."

Our assemblages of traits forming percepta are statistically similar to Brainerd's collections; reference to Figure 1 shows that, by analogy with his analysis, (A) comes first, followed by (B), (C), (D), and (E) in that order. In other words, the idealized sequence of percepta in southeast Australia is as follows:

1. Basic flaked pebble (including forms similar to the chopper, chopping tool, protohandax of Movius [1948]).

2. Completely flaked on both surfaces, with ground edge and reduction in radius of the sharpened edge.
3. Hammered surface with ground edge.
4. Grooved.

The left-right sequences in the matrix, mentioned above under Results, may now be interpreted as occurring from earlier through to later times, namely, a change from asymmetry to symmetry of edge, increase in radius of edge, introduction of grooving and increasing complexity of perceptum.

A much more thorough analysis is needed to show the actual course of events in any ecological region. The following forms which were undifferentiated in our original matrix scoring need to be treated: large flake adzes in which the inner side constitutes both one surface and edge of the artifact, split pebbles and split flint nodules used in a similar manner. The latter occur in far western Victoria, but are more common in extreme southeast South Australia outside the area from which our sample was drawn.

Comparison of Findings with Extant Classifications. There are 2 recent classifications including all, or nearly all, Australian aboriginal stone artifacts, and it remains to compare these with our findings. McCarthy (1946) classifies the axes and choppers as follows:

A. Trimmed coroid or core implements
  1. Nuclei
  2. Utilized nuclei
  3. Uniface coroids
    i. Pebble
    ii. Semiuniface
    iii. Uniface or Sumatra type
  4. Biface coroids
    a. Semibiface and biface
    b. Specialized type — Kodja
  5. Nucleiform burins

B. Knapped implements
  1. Blocks
    a. Crowned
    b. Carinate
    c. Burinate
    Specialized types
    d. Karta
    e. Arapia
  2. Slices
    a. Scraping
    b. Cutting
    Specialized types
    c. Split pebble
    d. Worimi cleaver
  3. Normal flakes and blades

C. Edge-ground implements
  1. Ax heads
    a. Uniface pebble or Windang
    b. Pebble
    c. Uniface blade
    d. Biface coroid
    e. Pecked
    f. Pecked and grooved
    g. Fully ground or polished
    h. Fully ground or polished and grooved
  2. Adz heads
    a. Trimmed biface coroid
    b. Pecked
    c. Pecked and grooved
    d. Fully ground or polished
    e. Fully ground or polished and grooved
    f. Adzlike

The second classification is that of Mitchell (1949), which, in its major features, is as follows:

FLAKED IMPLEMENTS

Class 1. Implements that function by being drawn or pushed lengthways
  a. Fortuitous cutting flakes
  b. Conventionalized knife flakes
  c. Saw knives

Class 2. Implements operated by being pushed or drawn back and forth transversely
  a. Scrapers
  b. Planes
  c. Adzes
  d. Microliths

Class 3. Implements that function by cutting or penetrating
  a. Pirries
  b. Biface spear points

CHOPPING IMPLEMENTS

A. Cutting edge produced by flaking
  a. Uniface, flakes from one surface only, edge acentral
    i. End chopper (= chopping tool, Movius 1948)
    ii. Slipper type
    iii. Side chopper
    iv. Sumatra
    v. Karta
    vi. Arapia
    vii. Windang
  b. Biface, flakes from 2 surfaces, edge central; includes biface pebble and biface block axes
    i. Biface pebble axes
    ii. Biface block axes
      1. Buandik type
      2. Worimi
      3. Kodjo

TABLE 1. CRITERIA USED IN THE MCCARTHY CLASSIFICATION OF AUSTRALIAN ABORIGINAL STONE IMPLEMENTS. The major categories are to the left, the minor to the right.

A Origin and Technique (trimmed coroid)	1 Origin (nuclei)	
	2 Origin (utilised nuclei)	
	3 Form (uniface)	i. Origin (pebble)
		ii. Form (semi-uniface)
		iii. Form (uniface)
	4 Form (biface)	a. Form (biface)
		b. Form (special type)
	5 Form (nucleiform burins)	
B Technique (knapped)	1 Form (blocks)	a. Form (crowned)
		b. Form (carinate)
		c. Form (burinate)
		d. Form (special type)
		e. Form (special type)
	2 Form (slices)	a. Function (scraping)
		b. Function (cutting)
		c. Origin (split pebble)
		d. Form and Function (Worimi cleaver)
	3 Form (flakes and blades)	
C Technique (edge-ground)	1 Function (axe)	a. Form and Origin (uniface pebble)
		b. Origin (pebble)
		c. Form (uniface blade)
		d. Form and origin (biface coroid)
		e. Technique (pecked)
		f. Technique and Form (pecked, grooved)
		g. Technique (ground)
		h. Technique and Form (ground, grooved)
	2 Function (adze)	a. Technique, Form and Origin (trimmed, biface coroid)
		b. Technique (pecked)
		c. Technique and Form (pecked & grooved)
		d. Technique and Form (fully ground)
		e. Technique and Form (fully ground, grooved)
		f. Form (adze-like)

B. Ground cutting edge; body produced by flaking, hammer dressing
C. Wedges
D. Edge-ground chisels
E. Digging tools

The traits used by both authors in respect of axes and choppers are clearly similar to our own; they must be, since form and technique are the obvious, observable aspects, and although our notion of perceptum is formulated ideally in terms of the artificer's ideas, operationally we must use traits which we can use and measure. Fundamentally, the perceptum is a unity. In this study, we want to emphasize the association of traits; but, for classificatory purposes, authors must place the traits in a hierarchy. Of the traits utilized in this study the manner of treating the surface is used by both authors in setting up submajor categories, a uniface-biface distinction being made by McCarthy among his "core implements" (category A) and by Mitchell among his "cutting edge produced by flaking" types (Chopping Implements, A). The distinction of hammer dressed and flaked appears in both classifications among edge ground implements. Manner of forming the edge is also used as a determinant of major categories by both authors. Curvature of the edge (radius in the present study), and shape (of outline) are considered by Mitchell in relation to the subdivision of his category B, "ground cutting edge, body produced by flaking or hammer dressing." But this is a minor usage and it is significant that one of these criteria, shape, was not found to be a good sorting criterion in this study. Mitchell recognizes the symmetry-asymmetry distinction among those implements he classifies as "cutting edge produced by flaking" and McCarthy among implements in his "edge ground" category. But, in the latter, this distinction appears in terms of "axe heads" and "adze heads," that is, by a resort to function. This is the weakest part of McCarthy's otherwise strong schema, probably because edge grinding is a trait found in association with any combination of traits which form the body of an ax and, moreover, does not have a governing quality in any such assemblage. Thus, so-called transitional type axes occur in the form of uniface pebbles with ground edge. These might well be classified as "uniface coroids" of McCarthy, with the one additional feature of edge grinding. For a similar reason, biface coroid appears in the "trimmed coroid" category (A, McCarthy), and also in the "edge ground" (C, McCarthy).

When the criteria used by the 2 authors are tabulated (Tables 1 and 2), it is apparent that their patterns of use of criteria are different. It is for this reason that the universe of implements used in this study of axes and choppers is included in Mitchell's major category "Chopping Implements," but divided among the "trimmed coroid" and "edge ground" categories of McCarthy. Mitchell uses function 3 times more often than McCarthy as a criterion in the setting up of a class (see Table 3). Moreover, he uses it at all levels of categorization, while McCarthy does so only in his minor categories, except for the ax-adz distinction among edge ground implements. McCarthy, on the other hand, makes much greater use of form and does so at all levels except his primary level of classification, while Mitchell uses it only for tertiary and quaternary categories. Technique is used 3 times as often by McCarthy, mainly in distinguishing among his "edge ground" types, but both authors use it for establishing major categories.

Our major perceptum B corresponds to a combination of A.3.i., A.3.ii. of McCarthy, and A.a.ii., A.a.iii. of Mitchell. Its associated minor perceptum A corresponds to A.4.a. of McCarthy and A.b.i. of Mitchell. It is suggested that these categories grade into one another and careful examination of a wide range of specimens would show that this was the case.

Our major perceptum C corresponds to C.1.d. of McCarthy and "Chopping Implements" B of Mitchell. The associated minor perceptum D corresponds to C.1.e. of McCarthy and to "Chopping Implements" B of Mitchell, and the minor perceptum E to C.1.f. of McCarthy and, again, to "Chopping Implements" B of Mitchell. The suggestion that ground edge and groove are separate traditions is met by McCarthy's separation of categories C.1.e. and C.1.f.

CONCLUSION

The commonest trait combinations occurring among aboriginal axes and choppers of southeast Australia are a cortex-flake surface with cortex-flake edge of a rather pointed type. This is associated with a major combination of traits which includes cortex appearing on both surfaces, offset, cortex-flake edge, a moderate radius of edge, and no groove. A third combination,

and one of major importance, is a double flaked surface, with a central ground edge of large radius of curvature. Associated with it are 2 further, minor combinations, namely, a ground edge with a hammered surface and a groove with a hammered surface. The trait combinations appeared chronologically in the order in which they have been described. Edge grinding, a fairly late introduction, may appear in combination with a number of earlier body types and demonstrates the phenomenon of progressive mixing. The geographical distribution of

TABLE 2. CRITERIA USED IN THE MITCHELL CLASSIFICATION OF AUSTRALIAN ABORIGINAL STONE IMPLEMENTS. The major categories are to the left, the minor to the right.

Technique (flaked)	1 Manner (lengthways)	a Natural			
		b Manufactured			
		c Function (saw)			
	2 of (transverse)	a Function (scraper)			
		b Function (plane)			
		c Function (adze)			
		d Size (microlith)			
	3 Use (penetrating)	a Form (uniface)			
		b Form (biface)			
Function (chopping)	A Technique (flaked edge)	a Form (uniface)	i		
			ii	Form and Function (ideal types)	
			iii		
			iv		
			v		
			vi		
			vii		
		b Form (biface)	i Origin (pebble)		
			ii Origin (block)	1	Form (ideal types)
				2	
				3	
	B Technique (ground edge)				
	C Function (wedge)				
	D Size and Function (chisel)				
	E Function (digging)				

TABLE 3. PERCENTAGE OF USE OF CRITERIA IN MCCARTHY. AND MITCHELL CLASSIFICATIONS OF AUSTRALIAN ABORIGINAL STONE IMPLEMENTS.

Criterion	*Times Used as Per Cent of Total* McCARTHY	MITCHELL
Form	41	21
Form and Origin	5	—
Origin	12	12
Origin and Technique	5	—
Technique and Form	12	—
Technique	12	9
Size	—	3.5
Size and Function	—	3.5
Function	10	21
Form and Function	3	21
Manner of Use	—	9
Form and combinations	61	42
Function and combinations	13	45.5
Technique and combinations	29	9

trait combinations suggests a cortex-flake and cortex-cortex surface (probably a pebble), combined with cortex-flake or double-flake edge, as characteristic of the north coast of New South Wales and utilization of similar body types on introduction of edge grinding, while double-flake surface and ground-edge specimens are characteristic of Victoria. Hammered-surface specimens are common in southern central and western Victoria.

Extant classifications of Australian aboriginal stone implements, while probably useful for the plotting of geographical occurrence of certain trait combinations, tend to obscure archaeological process and some of the categories are of doubtful validity. Mitchell's classification contains a number of categories on the same level which are not logically discrete.

The concept perceptum is suggested, to stand for an assemblage of features perceived by the maker of an implement as desirable and consisting, operationally, of a combination of measured traits. The perceptum is a construct standing between scientific measurement and the culture of the artificer.

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CERAMIC VARIETY, TYPE CLUSTER, AND CERAMIC SYSTEM IN SOUTHWESTERN POTTERY ANALYSIS*

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DURING the past 20 years, the number of named pottery types in the Southwest has increased at such a rate that it is now virtually impossible for an archaeologist to know and be familiar with more than a small percentage of them. Some of these types are totally new, but a surprisingly large number represent refinements in terminology or segregations from more inclusive categories, resulting from further study and increasingly complex technological analyses. This proliferation of named types has alarmed many archaeologists. There can, however, be no legitimate doubt that if the intricate ceramic history of the Southwest and other areas of the New World is to be understood, research analysts must be free to break down their material to as fine a point as necessary in order to localize in time and space the infinitesimal variants of pottery which constitute, with other aspects of material culture, the documents of regional prehistory. It is equally clear that some method must be found to integrate the smallest units into meaningful groupings of a larger order. Groupings of this kind are necessary in the derivation of cultural interpretations from archaeological materials.

Based on these assumptions, the purpose of this paper is to crystalize certain taxonomic concepts into a framework to serve present needs for classification of prehistoric pottery. These concepts are here termed "type," "variety," "type cluster," and "ceramic system." The concepts themselves are not new and the term "type" is retained in the sense that has become standard in Southwestern pottery terminology. The formulations dealt with have been discussed on many previous occasions and "variety" in particular has been used in a vague manner for at least 3 decades. A formal definition of the concepts is proposed so that ideas may be more precisely expressed through the usage of these taxonomic devices. This in turn should lead to less diversity in what the different terms stand for when employed by individual workers. Whenever possible, for purposes of illustration, particular examples have been selected from the Southwest, but it is our hope that the concepts will be applicable in other areas.

In arriving at the suggested categories, the method of ordering ceramic data into type, ware, sequence, and series designations as established by Colton and subsequent workers has been used to as great an extent as possible. Basic to the study of all prehistoric ceramics is the pottery "type." This concept is well known and, as defined for the Southwest by Colton (Colton and Hargrave 1937: 2; Colton 1942: 177; 1952: 1; 1953: 51, 55), is fundamental to our proposed taxonomy. To depart from or redefine the pottery type would be to scrap all previous ceramic classification in this area. This is neither desirable nor necessary, as it is our aim to build upon the foundation established by the Museum of Northern Arizona, Gila Pueblo, and others. Several criteria are of particular importance, in that a type is recognizably distinct in terms of certain visual or tactile characteristics, and has explicit temporal and areal associations.

In scope, the most inclusive of these categories is the ware. A "ware" is a large grouping of pottery types which has little temporal or spatial

* This paper, from its inception, has been a cooperative endeavor to produce a taxonomic framework suited to current needs for the analysis of ceramics in the American Southwest. A draft of the present work was discussed during informal meetings and an official session of the August, 1957, Pecos Conference held at Gila Pueblo in Globe, Arizona. Many ideas were exchanged during the conference, and to those who participated we express our appreciation for their constructive and stimulating remarks. The following persons took an active part in discussions and were most helpful with suggestions: David A. Breternitz, Harold S. Colton, Alfred E. Dittert, Jr., Rex E. Gerald, Emil W. Haury, Anna O. Shepard, Stanley A. Stubbs, Nathalie F. S. Woodbury, and Richard B. Woodbury. Special thanks are due Philip Phillips, Gordon R. Willey, Stephen Williams, and Hugo G. Rodeck for reviewing the final manuscript, Watson Smith and Robert F. Burgh for encouragement and editorial advice, and Carol A. Gifford for her editorial and secretarial assistance. The authors accept responsibility for the final form in which these concepts are presented. Charts are by James C. Gifford.

Apropos of what has taken place in the field of pottery analysis since the first Pecos Conference 30 years ago and of the ideas under consideration, the following remark in a recent letter from A. V. Kidder seems particularly appropriate: "As a matter of fact, I sometimes feel like an elderly rabbit returning to his home brier patch to find that he has left ten thousand descendants. . . ."

implication but consists of stylistically varied types that are similar technologically and in method of manufacture (Hargrave and Colton 1935: 49-51; Colton and Hargrave 1937: 1-2; Colton 1942: 177; 1952: 2; 1953: 52, 55; 1955: 2).

A "sequence" is more restricted in scope than a ware, and carries a connotation among its constituent types of evolutionary development. A ceramic sequence is composed of pottery types similar to each other in decorative style and other manifestations, which have evolved, one from another, from early to late times (Colton 1953: 75-8). Polychrome, black-on-red, black-on-white, corrugated, or plain types can each be arranged into separate sequences. Ceramic sequences necessarily transcend wares as indicators of developmental continuity and may include types or type clusters from any number of series.

A "series" consists of technologically related pottery types which are similar in decorative technique or, in the case of corrugated and plain types, surface manipulation or technique of manufacture alone. It is of importance in distinguishing a series from a sequence that the constituent types of a series occur within a definable geographical unit without exact limitation in time, and that these types must be within a single ware (Colton and Hargrave 1937: 3; Colton 1955: 2). A series is essentially geographical with respect to the implied relationship among the types within it, in contrast to evolutionary relationships implied among the types within a sequence. It must nevertheless be pointed out that the terms series and sequence have sometimes been used interchangeably. This usage has come about because in certain instances a series may contain all the members of an entire sequence. An example is to be found in the White Mountain Series which contains the complete White Mountain Polychrome Sequence (Colton 1955: 8). Future confusion can, however, be avoided if care is taken to utilize each of these terms strictly in accord with expressed definitions and intended meanings.

The Concept of Ceramic Variety

It is clear that prevailing taxonomic custom allows many named pottery types to differ from other types only in very minor ways, as in temper or style of decoration. While it is extremely important to name these variations for purposes of analysis and study, the practice of giving them all equal status as types has often resulted in attaching too much significance to the variant. The definition of pottery type is, in many instances, not always fulfilled by this method. Moreover, since each has a separate name there is no immediate way to indicate the relationship of one type to another or to distinguish variants from types. The only mechanism presently available for the designation of ceramic entities has therefore resulted in equalizing all such entities even when it is obvious that some are very close to each other in a vast majority of characteristics, while others differ markedly. That this defect in existing terminology has been recognized is patent from the fact that the term variety, or subtype, is often loosely used to refer to minor variants of a more widely known type, and that some types have been designated in publication as varieties.

In order that each entity described may be placed in a category according to its degree of distinctiveness, some method is needed to designate entities which do not differ markedly from a described type and yet are useful if given separate recognition. The requirement is a defined designation which differentiates such entities from established types. It is suggested that the concept of the "variety" fulfills the need, and that together with type, it may be used as both a working tool and a taxonomic device in the analysis of pottery.

The criteria used in defining a pottery type are decisive in the designation of varieties and their relationship to established types. A variety differs from the type to which it is related only in one or more minor particulars. In terms of geographical distribution and time span it may be equal to that of the type, although generally it is more restricted in one or both of these elements. A variety cannot be temporally and areally distinct from the type in any radical sense; nor can it differ conspicuously from the type in the manner of design execution, surface finish, or character of paint or paste utilized, else the variety warrants designation as a type. Colton describes a ceramic variety in much the same terms but his definition attributes varieties to "the vagaries of individual potters" (1946: 315) which may or may not be the correct interpretation, and fails to point out or emphasize the usefulness of variety in classification. Borderline cases of varieties that exhibit a potential as new types must, of course, be judged and

evaluated by the individual investigator in harmony with the basic definition of a pottery type and a variety. One of the reasons for stressing concepts per se is to permit the analyst of a potentially new type or variety freedom to place it within the framework without forcible insertion into any larger taxonomic category than may be deemed necessary.

A variety, then, differs from the type only in such lesser technological or esthetic features as may indicate a minor regional or temporal departure from the standard. Three aspects of variation may be enumerated: (1) one or more minor characteristics perceptibly distinguishing a variety from the type, (2) slightly differing or more restricted areal distribution, and (3) slight difference in time span from that of the type. The first factor is always foremost because it is on the basis of minor visually distinguishable characteristics that the variety is identifiable. After initial recognition, however, evidence may lead to an evaluation of the variety in terms of any one of the three factors. Therefore, as a result of the individual or collective presence of these factors, the concept of variety may be considered as manifesting itself in any of 3 possible ways and we may speak of 3 aspects of a variety: (1) technological or stylistic, (2) areal, (3) temporal. It cannot be overemphasized that in practice, varieties are first recognized by the presence of the technological or stylistic aspect, in combination with which may or may not occur either of the other 2 aspects. The nature of a particular variety may subsequently be indicated by stressing the factor or aspect which represents the most salient or significant departure from an established type. The following examples are presented to show what is meant by dominance of each of these 3 aspects of a variety.

Technological or stylistic aspect of a variety. This aspect denotes varieties which can be recognized and designated as departures from established types on the basis of a single or very few distinctive features of decoration or technology. Entities of this kind constitute technological or stylistic varieties. The smudged-interior varieties of Reserve Plain, Reserve Indented, Reserve Incised, and Tularosa Patterned Corrugated types (Rinaldo and Bluhm 1956: 155-71) are cases in point. In these the technique of smudging is the single distinguishing characteristic. Another instance is Jeddito Engraved (Colton 1956; Colton and Hargrave 1937) which is no more than a variety of Jeddito Black-on-yellow, and, as pointed out by Colton: "The recognition of this type is based entirely upon the appearance of a new variation in decorative technique, namely, engraving." The engraved elements of design consist of lines scratched through the black paint; otherwise the pottery is Jeddito Black-on-yellow. A more restricted time range has been inferred but has not been proven stratigraphically.

Another example, in this case recognized on stylistic grounds, has been cited by Colton in distinguishing 2 types on the basis of "differences in styles of design, Sosi Black-on-white and Dogoszhi Black-on-white. They are contemporary and are usually found associated. Indeed, cases are now known in which both styles of design appear on the same vessel. Obviously they belong to the same type" (1952: 2). It is not our intent to pass judgment as to whether this is a situation actually involving 2 distinct types (a position held by some archaeologists) or if indeed a type and its variety are involved. But assuming the correctness of Colton's interpretations and those of Rinaldo and Bluhm, it would be desirable if in the future, examples of this kind were designated taxonomically by the same mechanism as is suggested in the succeeding discussion concerning a variety of Kiet Siel Polychrome as an areal aspect. The implications of situations such as indicated in the Sosi-Dogoszhi example could be solved in this manner and possibly an unnecessary type designation in this way be avoided.

From the foregoing it is plain that while a variety is differentiated from a type on the basis of minor technico-stylistic differences, it, like the type, may in addition have certain temporal and areal implications. A variety may coincide with the type in both time and area (as in a true technico-stylistic variety), or it may differ to a minor degree in one or both of these factors. An areal aspect or a temporal aspect may in consequence be attributed to a variety.

Areal aspect of a variety. The occurrence of Kiet Siel Polychrome at the ruin of Awatovi furnishes a convenient illustration of a variety that displays areal significance. Kiet Siel Polychrome as described by Colton and Hargrave (1937: 100-1); Beals, Brainerd and Smith (1945: 107-37); and Colton (1956) is found at Awatovi. In association with it occur bowls which differ from the type description by having an exterior band or panel of decoration using white or black and white paints on a red background, similar to the interior combination of colors. In the Marsh Pass-Kayenta region, exterior decoration is either absent or limited to horizontal red stripes encircling the vessel just below the rim. The paneled exterior bowl decoration executed in 2 or 3 colors is, as thus far known, peculiar to Awatovi or the Jeddito region and clearly distinguishable from Marsh Pass type sherds. Necessarily this distinction of an areal variety is confined to bowl forms.

The question arises as to whether this pottery should be accorded type status. A somewhat similar case occurred when Colton (1937: 156; 1956) accorded Kawaika-a Polychrome (called Kawaioku Polychrome by Colton) type status, distinguishing it from Sikyatki Polychrome.

In the Kiet Siel instance, although the differences are at least as great as the Kawaika-a-Sikyatki differences, it does not seem wise to establish a new type because there is no difference between the vessels found at Awatovi and Kiet Siel Polychrome, except the exterior decorative style in bowl forms. Both probably have the same temporal value; whereas a new type should not only be recognizably different from its most closely comparable type, but should also be assignable to a different time and locality.

The importance of the differences in the 2 kinds of Kiet Siel Polychrome lies in the recognition of a local or areal variety at Awatovi which is not temporally distinct from the established type. The entity is no more than a variation in style of decoration from that of the established type. This style of decoration is peculiar to a certain region of northern Arizona. Such a variation is not only distinguishable from the established type by a difference in decorative technique but by restriction of that technique to a locality within or at the margin of the larger areal range of the established type. The taxonomic status which seems best suited to this situation is expressed by the term "variety," prefaced by the site name or a geographical name selected from the immediate territory, all of which must follow the established type name; thus: "Kiet Siel Polychrome: Awatovi Variety." If such a designation had been adopted in the Kawaika-a-Sikyatki Polychrome situation previously mentioned, we would speak of "Sikyatki Polychrome: Kawaika-a Variety."

This method of identification is consonant with the rules of naming set forth by Colton and others and long accepted in the Southwest (Colton 1953: 52-5; Gladwin, W. and H. S. 1930: 1-3; Kidder 1927: 489-91; Colton and Hargrave 1937: 19-22; Hargrave and Colton 1935: 49-51). It is applicable to technological, areal, or temporal aspects of variation for the simple reason that in order to be recognized, the sherds and vessels of any variety must first be found at *a* site or within *a* given district. The name itself does not, of course, necessarily determine the "area of greatest density, for the name simply serves as a label for reference" (Colton 1953: 53). Later study may enlarge the area of its occurrence, or show its greatest frequency of occurrence to be in another locality.

It is possible that this taxonomic usage might be considered cumbersome, and when followed to its ultimate conclusion, it assumes such proportions as "Three Circle Neck Corrugated: Point of Pines Variety" (Breternitz 1957: 36). Despite such objections, this terminology seems to have overriding merit for designating what is intended, that is, an areal or temporal variation of style or technology which carries no other significant differentiation from the related type, but which constitutes a recognizable entity peculiar to a certain locality or time.

This taxonomic designation is more concise than qualification of the type name by a statement to the effect that at Awatovi a few bowls of Kiet Siel Polychrome occurred which exhibit an unusual kind of exterior decoration. Such a statement is inadequate because it fails to emphasize the distinctiveness of the variation and it is awkward for colleagues to use, especially when making comparative comments. The knowledge that certain decorative or technological ceramic features are widely distributed and others are restricted to certain localities is of great importance for the study of prehistoric ceramics in relation to the cultures which made, used, and traded them. It is therefore vital to observe and designate variations when they are discernible. The above taxonomic procedure makes it possible to do this in a systematic way.

Temporal aspect of a variety. Kiet Siel Polychrome: Awatovi Variety was described as an illustration of a geographic variant. There are also varieties which largely overlap the time range of an established type but which have a time range of their own slightly different from that of the established type. Varieties of this kind may or may not have meaning in terms of area, but in either case they have a peculiar temporal aspect which may be more important or more evident than areal or technological considerations in terms of analysis.

As an example, a variety of Reserve Black-on-white (Danson 1957: Table 19, Fig. 17 *a*) may be cited. This ceramic variation is described as a local development of black-on white pottery which coincides with late Pueblo I-early Pueblo II and "with the ceramic developments of Red Mesa Black-on-white, but which differs in having a darker paste and a much heavier slip, and in showing a suggestion of the later Reserve style of decoration" (Danson 1957: 92). It is referred to by Danson as an "early variant of Reserve Black-on-white" and as "Reserve Black-on-white (early variant)" (1957: 100). On the basis of these assertions this variety may be construed as being earlier than, but probably overlapping in time, Reserve Black-on-white as described from the vicinity of Reserve, New Mexico (Martin and Rinaldo 1950: 502-19). There is a suggestion of significant areal differentiation but the temporal implications seem at the moment more demonstrable and important and it is therefore considered a temporal variety. This temporal variety of Reserve Black-on-white should not, however, be confused with Reserve Black-on-white: Black River Variety, also described by Danson (1957: 92-3). Socorro Black-on-white is another established type that may yield recognizable temporal variations (A. E. Dittert, personal communication, 1957).

Several concluding points concerning the concept of variety must be made. Circumstances of excavation may be influential in the initial or preliminary determination of a type or a variety. It is possible that due to the incompleteness of knowledge concerning a given ceramic situation the first ceramic entity excavated and described will become the type while entities recognized at a later date become varieties. To obviate the permanence of such conclusions and make it possible for new knowledge to rectify prelimi-

nary findings which may prove false, the constructs of variety and type must be kept fluid. To this end the status of a variety must be conceived as being temporary to the extent that: (1) some type descriptions may eventually be broadened to include tentative varieties, (2) within some type clusters certain varieties may eventually be dropped altogether as no longer useful, (3) some entities now described as types may be judged to be in fact varieties, or (4) some varieties may eventually be established as types in their own right.

An example of the last of these possibilities came about with the elevation of Fourmile Polychrome: Point of Pines Variety to the status of Point of Pines Polychrome. Although at first recognizably distinct and more restricted in area than Fourmile Polychrome, this pottery did not at that time appear in an archaeological context which presented more than a bare hint of temporal departure from that encompassed by the established description of Fourmile Polychrome. It was for this reason tentatively termed Fourmile Polychrome: Point of Pines Variety (Wendorf 1950: 43-59). The University of Arizona Archaeological Field School continued operations in the Point of Pines region of Arizona and subsequently demonstrated stratigraphically that this pottery was indeed associated only with the Point of Pines phase, at a time distinctly later than the occurrence of Fourmile Polychrome. In addition, greater quantities of this pottery were unearthed and its distinguishing features became more conspicuously manifest so that its distinctness rested on a configuration of major characteristics rather than minor ones (Wasley 1952; Morris 1957). Consequently, its separation from Fourmile Polychrome was justified beyond any reasonable doubt. It was therefore redesignated Point of Pines Polychrome in keeping with the basic definition of a type.

The Concept of Ceramic Type Cluster

The idea of the variety as outlined here has previously been utilized to a limited extent in earlier studies of Southwestern ceramics — first in Alma Plain: Forestdale Variety (Haury 1940: 72; Haury and Sayles 1947: 48-52) and in San Francisco Red: Saliz Variety (Martin and Rinaldo 1940: 80-1; Martin 1943: 240-1), in Alma Plain: Bluff Variety (Haury and Sayles 1947: 48-52), and later in Alma Plain: Point of Pines and Black River varieties (Wheat 1954: 82-7). A uniform taxonomic treatment of recognizable varieties has, however, never been adopted even though it is generally agreed that such treatment has long since proved its usefulness for the comparative study of pottery types. Our concept of established types, each with its own constellation of varieties, is outlined here to provide a standard method for identification and designation of varieties. The definition, description, and number of varieties which are related to any given type is determined, of course, by the individual worker's appraisal of the archaeological data at hand.

If the taxonomic devices already discussed are considered useful and the implications of each are understood, it now seems desirable to crystallize and name a more inclusive concept, a unit which contains the type and its associated varieties. This will permit a grouping of individual types plus their varieties into meaningful entities which can then be considered as independent units. Units of this kind can be used in accordance with the dictates of any particular problem and larger configurations may be formed which tend to have a greater cultural significance than any more restricted unit may display by itself. The term "group" cannot be applied to this concept because Colton (1953: 65) has used it in the sense of a ceramic complex or assemblage which recognizes contemporaneity among individual types. The idea of the ceramic group is discussed more fully at a later time. The term "cluster" is, however, free of prior archaeological implication and we suggest that "type cluster" be used to refer to the constellation that is formed when one type including all of its varieties is considered as a single unit. Figure 1 illustrates several examples.

A type cluster consists of one type together with its varieties. These varieties, of which theoretically there can be any number, bear a relationship to the type such as has been detailed in the account of Kiet Siel Polychrome and Kiet Siel Polychrome: Awatovi Variety (Fig. 1). This conception of a type cluster permits free accommodation of type and variety within one unit. There is always space in a cluster for the designation of new varieties as they are recognized. A type cluster is as restricted in time and area as the temporal and areal value of the type *plus* any additional time and area encompassed by the varieties within its sphere. Furthermore, type clusters can be

grouped and regrouped into categories of a higher echelon when the need arises.

The type cluster allows for a great deal of flexibility and expansion to suit the needs of any given ceramic situation. Those whose problems necessitate fine ceramic breakdowns will be able to achieve their desires within the framework of the variety, the type, and the type cluster without necessarily designating new types. Those who think about ceramics in larger, more inclusive categories may satisfy themselves by working with type clusters alone. For example, instead of particularizing Sikyatki Polychrome, Sikyatki Polychrome: Kawaika-a Variety, and Sikyatki Polychrome: Awatovi Variety, the more inclusive grouping *Sikyatki Polychrome Cluster* (Fig. 1) may be used to designate all of the 3 smaller entities (one established type plus 2 related varieties).

A ceramic type cluster takes its name from the established type. The type, as distinguished from its varieties, is determined by the fact that it has the most comprehensive descriptive, geographical, or temporal range of the cluster. The entities related to it are varieties in a technico-stylistic, areal, or temporal sense. If, on the other hand, it can be shown that all the members of a type cluster are roughly equal in typological status, as may be the case with Alma Plain and its varieties (Forestdale Variety, Bluff Variety, Point of Pines Variety, and Black River Variety), then according to Colton's rules of naming and priority (1953: 52-5), the one first described in published form lends its name to the cluster; therefore the proper taxonomic title would be Alma Plain Cluster. It must be made clear that situations similar to that which pertains to the Alma Plain Cluster may be more frequent than has been implied (particularly with regard to relatively unstudied utility types), and indeed, in other areas may be the rule rather than the exception. The established type and its varieties within a type cluster may therefore, in certain instances, be indistinguishable in all major attributes and separable only on the basis of minor distinctions.

THE CONCEPT OF CERAMIC SYSTEM

Having formulated the type cluster as a working unit, clusters can in turn be grouped into entities having cultural significance. These larger entities derive from intercluster similarities which are relatively shallow in time depth. Basic to the concept is the fact that by an arrangement of contemporary type clusters, larger units are formed indicative of the pottery characteristic of a culture at a given period or time level in the development of that culture. The term ceramic system is proposed for this purpose.

A "ceramic system" is a grouping of type clusters which are related in design style, or surface manipulation when present, vessel form, and general technology (broadly speaking a class of

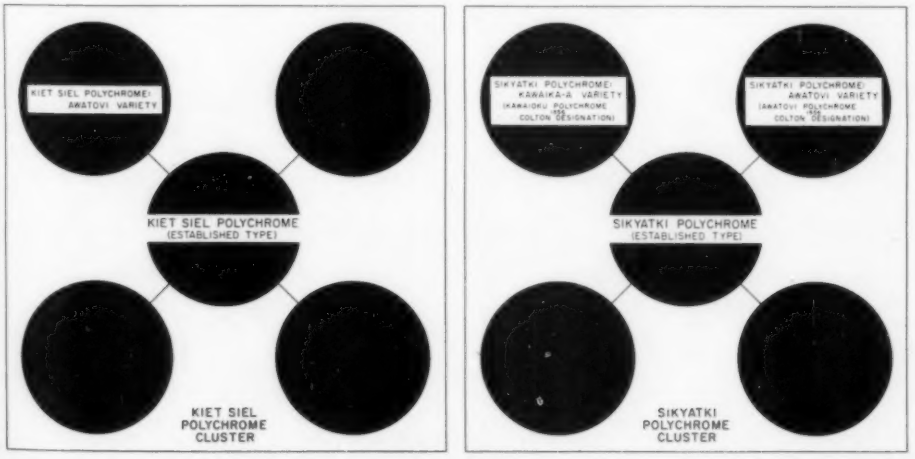
KIET SIEL POLYCHROME: AWATOVI VARIETY
KIET SIEL POLYCHROME (ESTABLISHED TYPE)
KIET SIEL POLYCHROME CLUSTER
SIKYATKI POLYCHROME: KAWAIKA-A VARIETY (KAWAIOKU POLYCHROME 1936 COLTON DESIGNATION)
SIKYATKI POLYCHROME: AWATOVI VARIETY (AWATOVI POLYCHROME 1936 COLTON DESIGNATION)
SIKYATKI POLYCHROME (ESTABLISHED TYPE)
SIKYATKI POLYCHROME CLUSTER

FIG. 1. The Kiet Siel Polychrome Cluster and the Sikyatki Polychrome Cluster. Solid black circles represent potential varieties of an established type, of which there may be any number.

FIG. 2. The Lino Black-on-gray Ceramic System and the Kayenta Polychrome Ceramic System. Solid black circles represent potential varieties of an established type, of which there may be any number.

pottery), and which range over a wide area, but are roughly contemporaneous. A ceramic system usually crosscuts wares. The relationship of type clusters contained within a system rests on broad characteristics which transcend individual types or clusters. A system may, however, in its simplest form, be a single type cluster; more often and most usefully, it is composed of a number of type clusters.

Two ceramic systems are shown in Figure 2. It will be observed that in these 2 ceramic systems all units dealt with are, for purposes of illustrating the ceramic system concept, labeled type clusters on the assumption that even though there are at present no recognized varieties for a given type, there is provision for their existence and ultimate recognition. In actual practice, a ceramic system will not be made up entirely of type clusters but will be composed both of type clusters and types lacking described or recognized varieties. One such grouping of types and type clusters is the Lino Black-on-gray Ceramic System (Fig. 2), composed of type clusters from 3 different wares. It is, however, made up of all known Basketmaker III black-on-gray potteries and consequently may be defined in terms of a class of pottery made by Basketmakers during a certain period in their cultural development within their area of occupation.

If the suggested taxonomic method of designating varieties is adopted and the classification of Twin Trees Black-on-white as a variety of Chapin Black-on-white is agreed upon as shown in Figure 2, Twin Trees Black-on-white would be renamed Chapin Black-on-white: Twin Trees Variety. All of the pottery in this system sometimes, if not always, shows a fugitive red exterior. By including black-on-gray and black-on-white type clusters in the Lino Black-on-gray Ceramic System, it appears superficially as if one of the qualifications of a ceramic system (that all included pottery be of one class) is, in this example intentionally ignored. This is not the case, however, because specialists in Basketmaker III pottery recognize that the terms black-on-gray and black-on-white are almost interchangeable descriptively when applied to different types of this class. This situation has come about because the surface color of almost all Basketmaker black-on-gray pottery shades into white and black-on-white pottery into gray.

There are general attributes which are basic to every Basketmaker III black-on-gray pot; when the Basketmakers manufactured black-on-gray pottery, they had an idea in mind as to how that pot should look. The concept of the ceramic system refers to a cultural image which the people were trying to produce in a class of ceramics during a certain interval of prehistoric time. In this way, a ceramic system takes into account cultural implications at a given period of time over a definable area. Therefore when an archaeologist picks up a Basketmaker III black-on-gray sherd, he can say that from an over-all view it is a sherd representative of the Lino Black-on-gray Ceramic System during Basketmaker III in the Anasazi area. If generally applied in the Southwest, other type clusters and types would be grouped into ceramic systems and this scheme would consolidate all pottery into some 40 or 50 ceramic systems of this kind. Thus through the recognition of these ceramic systems, it would further be possible for an archaeologist to assign to a general area and time span almost any of the plethora of specific types or varieties which only a specialist in that area might know by name. Because of certain gross characteristics, rendered explicit by inclusion within a ceramic system, a sherd or vessel could be recognized as early Pueblo III from the Kayenta or the Mesa Verde, or as Mogollon IV from the Point of Pines region, without a knowledge of its specific type name or the technical aspects of its manufacture.

During Pueblo III times ceramic specialization became more complex than in Basketmaker times. Consequently, the Pueblo III ceramic systems (black-on-white, black-on-red, polychrome, corrugated, and others, each including a number of related type clusters) became more numerous. The Kayenta Polychrome Ceramic System is shown as an example (Fig. 2). In contrast with the Lino Black-on-gray Ceramic System, the members of the Kayenta Polychrome Ceramic System belong to a single series within a single ware: Black Mesa Series, Tsegi Orange Ware (Colton 1956; 1955: 13). In this instance, although the representation of these types at Awatovi is insufficient to actually determine their type-variety status, Citadel, Tsegi, and Dogoszhi polychromes are included and shown as established types on a tentative basis for purposes of illustrating the concept. These 6 polychrome type clusters, therefore, constitute a particular entity indicative and representative of polychromes (a class of pottery) during the Pueblo III period within the Kayenta-Jeddito region of northern Arizona. Similarly, other

polychrome ceramic systems during Pueblo III are expressive of other cultural affiliations and regions. For example, Jeddito, Kwaituki, Kintiel, Klageto, Heshotauthla and other polychromes might be assigned to a Pueblo III ceramic system represented in the Hopi-Little Colorado-Zuni region of Arizona-New Mexico. This hypothetical ceramic system would overlap the Kayenta Polychrome Ceramic System in the Hopi Mesas and the interrelationship is indicated in the Kayenta-Hopi Polychrome Sequence (Fig. 3) where Kiet Siel and Jeddito polychromes are shown to have developed one into the other. The ceramic systems themselves reflect cultural interchange between adjoining regions.

A ceramic system may be defined as representing a certain class of pottery (in the first example, black-on-gray; in the second, a certain class of polychrome), made or used by the people of a certain archaeological culture, in a certain area during a certain period of time. Significant criteria are the period of time and the culture or people represented, and the area or region involved. The significance of any or all of these criteria fluctuates according to the ceramic system being formulated and its over-all context. A ceramic system should be thought of in terms of a time *period* (Basketmaker III, Pueblo III, and so forth) rather than a phase. There may be one or several phases in a period and a period may be one or several centuries in duration. The same principle is true of the ceramic system in terms of time and one or more archaeological phases may be spanned by the length of time embraced in the duration of any particular ceramic system.

It will be noted that our definition of ceramic system is concordant with that of a pottery type, but the very important difference is that the ceramic system is far more inclusive and has a much more general cultural frame of reference. The ceramic system is usually and most usefully short in time duration (commensurate with the archaeological period it is associated with), showing little or no evolution among member type clusters, but is wide in geographical range by comparison with a ceramic sequence which shows a demonstrable evolution among member type clusters but is limited in range and long in duration. Cultural processes are implicit in the taxonomic structure here described, and all the categories, from smallest to largest, find practical employment in the taxonomic designation of manifestations and entities of culture. At this time and for the purposes of this paper, it is suggested that only type clusters and types belonging to one class of pottery (polychrome, or black-on-white, or corrugated, or plain, and so on) be included in a single ceramic system. However, it is observed that the relationship of some polychromes to some bichromes is so close that it may ultimately prove useful to modify the definition of the term ceramic system to include such closely related types and clusters when they are contemporaneous.

In naming a ceramic system Colton's rules of taxonomic priority are followed (1953: 52-5), and the system takes the designation of the first-named type in the system. As a result, Lino (in the first ceramic system cited) and Kayenta (in the second ceramic system cited) become ceramic system names by reason of seniority in their published description. However, among the clusters of a system, no superior rank is conferred upon the one that gives its name to that system. There is no standard by which one type cluster can be rated higher or lower than another in relative importance.

Contrasts between ceramic system and other transcending terms. A brief discussion of terms which are similar but do not correspond with our concept of ceramic system may be of value. "The ceramic group is defined as an assemblage of contemporary, usually painted, pottery types recognized in a restricted area at sites occupied for a short period of time" (Colton 1953: 65). As used by Colton, black-on-white, black-on-red, and polychrome types may be included within a single group. Other analysts have also included corrugated, red, and plain types (Olson and Wasley 1956: 257-8) in arriving at ceramic groups, and in that way the terms ceramic group and ceramic complex are almost identical in use and meaning. The ceramic complex is an instrument for dating a site or the phases within a site because, in its entirety, it represents an inventory of the pottery types peculiar to a particular archaeological phase (Gifford 1957: 118-26, Figs. 31, 99, 100, 138). A ceramic system differs from a complex in that only one class of pottery is included in the former. For example, the Lino Black-on-gray Ceramic System (Fig. 2) imparts the idea of black-on-gray pottery made by Basketmaker people (culture) over a certain geographic extent (area) during the Basketmaker III period (time level). Thus the black-on-gray class of pottery is considered as an integrated whole apart from polychrome, black-on-orange, or corrugated types or clusters of the same or later periods, each of which is in its own ceramic system, according to the class of pottery it represents.

The terms "ware" and "index ware" are unsatisfactory because in scope they are too broad and in structure too loose for present purposes. "The Index Ware is defined

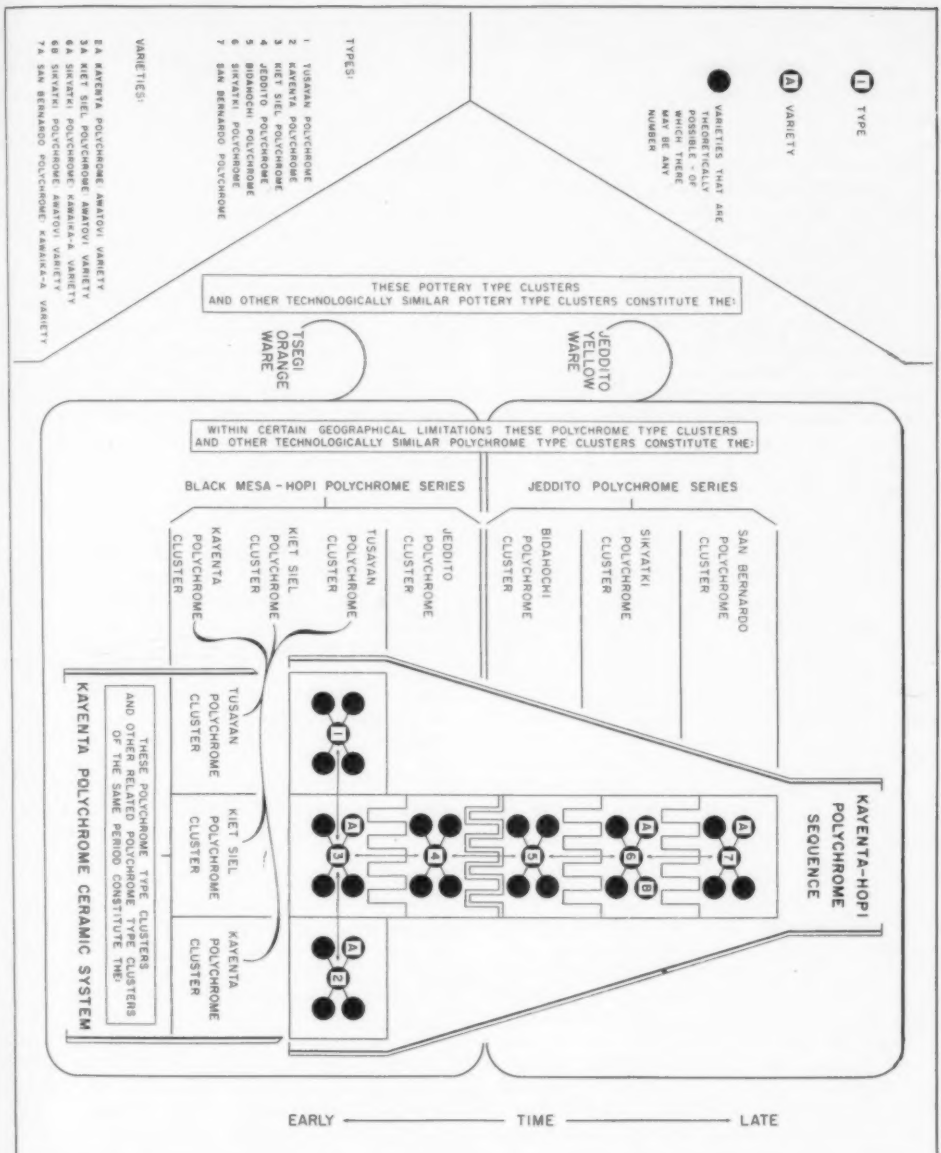
TYPE
VARIETY
VARIETIES THAT ARE THEORETICALLY POSSIBLE - OF WHICH THERE MAY BE ANY NUMBER
TYPES:
1 TUSAYAN POLYCHROME
2 KAYENTA POLYCHROME
3 KIET SIEL POLYCHROME
4 JEDDITO POLYCHROME
5 BIDAHOCHI POLYCHROME
6 SIKYATKI POLYCHROME
7 SAN BERNARDO POLYCHROME
VARIETIES:
2A KAYENTA POLYCHROME ANASTOVI VARIETY
3A KIET SIEL POLYCHROME ANASTOVI VARIETY
6A SIKYATKI POLYCHROME KAMAKA-4 VARIETY
6B SIKYATKI POLYCHROME ANASTOVI VARIETY
7A SAN BERNARDO POLYCHROME KAMAKA-4 VARIETY
THESE POTTERY TYPE CLUSTERS AND OTHER TECHNOLOGICALLY SIMILAR POTTERY TYPE CLUSTERS CONSTITUTE THE:
TSEGI ORANGE WARE
JEDDITO YELLOW WARE
WITHIN CERTAIN GEOGRAPHICAL LIMITATIONS THESE POLYCHROME TYPE CLUSTERS AND OTHER TECHNOLOGICALLY SIMILAR POLYCHROME TYPE CLUSTERS CONSTITUTE THE:
BLACK MESA - HOPI POLYCHROME SERIES
JEDDITO POLYCHROME SERIES
KAYENTA POLYCHROME CLUSTER
TUSAYAN POLYCHROME CLUSTER
KIET SIEL POLYCHROME CLUSTER
JEDDITO POLYCHROME CLUSTER
BIDAHOCHI POLYCHROME CLUSTER
SIKYATKI POLYCHROME CLUSTER
SAN BERNARDO POLYCHROME CLUSTER
KAYENTA-HOPI POLYCHROME SEQUENCE
KAYENTA POLYCHROME CERAMIC SYSTEM
THESE POLYCHROME TYPE CLUSTERS AND OTHER RELATED POLYCHROME TYPE CLUSTERS OF THE SAME PERIOD CONSTITUTE THE:
TUSAYAN POLYCHROME CLUSTER
KIET SIEL POLYCHROME CLUSTER
KAYENTA POLYCHROME CLUSTER
EARLY — TIME — LATE

FIG. 3. A graphic summary presentation of variety, type, type cluster, series, ceramic system, ceramic sequence, and ware, used as taxonomic devices to show technological, temporal, cultural, and areal interrelationships and similarities among certain ceramic manifestations.

as a pottery ware including a number of more or less similar types used for cooking and storage and which are peculiar to a certain prehistoric tribe . . . the characters that are selected to describe a ware are usually the basic techniques of manufacture which are handed down from mother to daughter and which persist over a long period of time. Some wares we can trace over eight hundred years" (Colton 1953: 67). A ceramic system differs from a ware in that the various component parts of a system are all of one class of pottery (that is, black-on-gray) and are grouped together by reason of attributes other than the gross technological and functional attributes common to the components of a ware. A single ceramic system contains type clusters of a single class; hence polychromes are not included in a black-on-white ceramic system nor black-on-white types in a black-on-red system. A ware on the other hand may include plain, corrugated, and decorated types. Ceramic systems may be wider in cultural and geographical scope than wares, and may cut across the wares established by Colton (1955: 3-26) as is shown by the Lino Black-on-gray Ceramic System illustrated in Figure 2.

The idea of analogous types has also been promulgated (Colton 1943: 316-20): "When the same style of design is found on pottery types of the same age but belonging to different wares, those types are said to be analogous" (Colton 1953: 71). This particular concept is closely allied to that of "horizon style" as used in Middle and South America (Willey 1945: 49-56; Parsons 1957; Willey and Phillips 1958: 31-2), which is usually based almost exclusively on ceramic art styles. The analogous-type concept differs from that of the ceramic system in that the latter includes other properties besides decorative style in arriving at pottery groupings indicative of a specific period, archaeological culture, and region in prehistory. A grouping of analogous types could, nevertheless, constitute a horizon style, and it is possible that in special instances a given ceramic system may be composed entirely of analogous types. In this event, the usefulness of the unit as a whole is greatly improved by designating it as a ceramic system rather than by saying only that the types or clusters under consideration are analogous.

A "horizon marker" is any unique trait, or by definition an "item" which at a specific time horizon has spread beyond its source over a wider geographical range. "Geographically wide distribution and brief duration" (Parsons 1957: 119) are key characteristics of the horizon marker. Horizon markers are "certain highly specialized and widely traded artifacts" (Phillips and Willey 1953: 626). A horizon marker can be a method of "treating material (technique) as incising, modelling, polychrome painting, negative painting" or a special form such as "a certain vessel shape . . . a type of foot, ridges, or applied effigies, or in some cases a specific design element" (Parsons 1957: 100). The term ceramic system (representing a number of type clusters rather than any single kind of artifact, trait, or item) is not, therefore, synonymous with horizon marker. A ceramic system is larger in scope than any specific item.

Various taxonomic concepts which can be used in association with our own constructs of variety, type, type cluster, and ceramic system are most useful in throwing light on other cultural phenomena. Foremost among these are the concepts of tradition (Thompson 1956: 38-9; Rouse 1957: 128) and, as previously noted, horizon style (Willey 1945: 49-56; Willey and Phillips 1958: 29-34), which may be used in the sense of their original definitions and descriptions. A tradition has temporal continuity and may progress in time through any number of successive ceramic systems. A horizon style is comparatively short in duration and may extend on a single time level through any number of contemporary ceramic systems.

Throughout the discussion and presentation of our various concepts, many of the specific examples used are taken from among pottery found at the site of Awatovi. The Awatovi Expedition of the Peabody Museum, Harvard University, during 1935-39 excavated at the great Hopi-Spanish ruin of Awatovi on Antelope Mesa within the Hopi Indian Reservation in northern Arizona (Brew 1942). The considerable collection of ceramic material provides examples which are illustrative because of the long time span encompassed by intensive occupation of the site. A summary expression in graphic and taxonomic terms of the affiliations between certain decorated pottery types indigenous to Awatovi is presented in Figure 3. It is intended to show the technological, developmental, temporal, cultural, and areal interrelationships of the pottery involved. By means of Figure 3 it may be seen how terms such as ware, sequence, series, ceramic system, type cluster, type, and variety can actually be employed to express meanings peculiar to each of them.

Kiet Siel, Jeddito, Bidahochi, Sikyatki, and San Bernardo polychromes comprise the Kayenta-Hopi Polychrome Sequence. This is, therefore, composed of polychrome type clusters derived from the Black Mesa Series, the Hopi Series, and the Jeddito Series which in turn are extracted from the Tsegi Orange Ware and the Jeddito Yellow Ware as grouped by Colton (1955: 12-14; 1956). These type clusters develop from one another through time within the sequence and are one illustration of ceramic continuity within the region. Citadel, Tsegi, and Dogoszhi polychromes (Colton 1956) belong to a more westerly occurrence of the Kayenta-Hopi Polychrome Sequence as well as being a part of the Black Mesa-Hopi Polychrome Series. These have not been included in Figure 3 because they do not occur in quantity at Awatovi and their type-variety status has not been appraised in the light of the concepts defined here. They were nevertheless included for purposes of discussion only in the Kayenta Polychrome Ceramic System as shown in Figure 2, but Figure 3 makes due allowance for this inclusion by stating that the polychrome type clusters shown may have added to them other polychrome type clusters of the same period to complete the Kayenta Polychrome Ceramic System. Each type cluster has been given equal vertical space within Figure 3 because it is not germane to this presentation to enter into the exact

relative time valuation of the individual types or type clusters.

A "series" is essentially geographical in orientation. Tusayan, Kayenta, Kiet Siel, and Jeddito polychromes are the principle constituents of the Black Mesa-Hopi Polychrome Series at Awatovi. This grouping of polychrome types, together with others included by Colton (1955: 13) from the Marsh Pass locale, is indicative of a restricted geographical unit — the entire Black Mesa or Kayenta-Jeddito region. Bidahochi, Sikyatki, and San Bernardo polychromes are the principle constituents of the Jeddito Polychrome Series at Awatovi, which is, with several other late polychromes recognized by Colton (1955: 14; 1956), indicative of a smaller district known as the Hopi Mesas or Jeddito region. As used by Colton (1953: 42; 1955: 1-43), sequence and series in certain instances appear synonymous, but this is, as previously pointed out, rarely the case and a sequence always connotes an evolutionary succession of related types through time, whereas a series is essentially a geographical grouping. Basically, as explicitly stated by Colton, "wares can be split into geographical series: (sub wares)" (Colton 1943: 317).

CONCLUSION

The fundamental requirement of taxonomic procedure is to make the analyst's own observations useful and available to others who now or in the future, work with the same problems and data. In any taxonomic structure designed for archaeological materials, the research worker must be allowed freedom of choice, and the structure which he uses must be flexible enough to permit the breaking of working entities into the smallest units required. These small units may then be reassembled in any desired manner at the discretion of any other archaeologist according to his estimate of a given situation, and yet still be within the framework of the established taxonomic structure. We have made every effort to leave as great a measure of flexibility as possible in the actual use of the taxonomic categories suggested here so that others may have freedom in approaching differing problems while using this framework.

It may be argued that by combining varieties and types into type clusters and type clusters into ceramic systems, the interpretation of evidence is prejudiced. If, however, bits of evidence are related on the basis of their own merits and characteristics, no prejudice is involved and the entire scheme becomes no more than a method for penetrating the unknown on the basis of objective evidence.

In our opinion, none of the foregoing suggestions does violence to existing taxonomic structures. The final test of any recommended procedure, taxonomic or otherwise, is its usefulness and workability. We therefore hope only that other investigators shall try out these concepts and taxonomic devices in the analysis of archaeological materials, both materials under active study and those already published. If they choose to arrange their observations upon this taxonomic lattice, the publication of their results together with any criticisms or suggestions for modification will be most welcome.

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WESTERN AMERICAN PREHISTORY — AN HYPOTHESIS*

DOUGLAS OSBORNE

RECENTLY I published a paper, together with Warren Caldwell and Robert Crabtree, disagreeing with an old theory that the development of most of Northwest Coast culture was due to movement of inland groups down the rivers to the seacoast where they proliferated physically and culturally (Osborne, Caldwell, and Crabtree 1956). We indicated (p. 117) that we did not propose to discard an old concept but suggested, rather, further evaluation and examination of alternate hypotheses, for we felt the reconstruction of Northwest Coast prehistory was only in the hypothesis stage.

My conception of scientific advance may, perhaps because of personal idiosyncrasies of thought, confuse ideas with less abstract entities. Be that as it may, I see the increase of knowledge as an essentially irregular or jerky growth, marked by competition among ideas, hypotheses, and sometimes even bodies of data, which may be striving for general acceptance. This competition is a well-recognized attribute of our society; indeed, it is doubtful that science as we know it could have developed in the calmer, better organized, and better disciplined cultures which, if we may believe some of our colleagues, are more characteristic of man as a social animal than is our constant competition.

If science among ourselves is inherently competitive, then it follows that at least a moderate intensity of competitiveness is necessary for its successful growth. Therefore it behooves a scientific worker to present his ideas, his pros and cons, in order that they may compete with such other ideas as there may be. Data and ideas must not languish unpresented; if they do their competitors may win general acceptance by forfeit and an unhealthy imbalance arise between competing theories or bodies of data. In this situation "truths," which may be half truths only, may become graven upon the scientific mind, whence, happily, they are not as difficult to dislodge as when they are graven on the popular mind (or at least so we would like to think). Thus it should be best at certain stages of scientific growth that a state of balance be maintained between competing interpretations. In this manner, I feel, a stronger competition will be stimulated and the ideas which finally win out should be nearer to the real truth which we must suppose to exist.

For the foregoing reasons I should like to present a modified and generalized sketch of the hypothesis which I, with others, attacked in one detail only in 1956.

* * *

Many students have pointed out the importance of ecological considerations in studies of western prehistory (see especially McKern 1956: 360; Cressman 1951: 309). This is a useful viewpoint and I feel that we are now at a position where the general situation visualized for human life during the Postpleistocene may be tested from an ecological point of view. Economy, ecology, and environment are all basic to

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the formulation of concepts of culture growth and change.

It is apparent that a vast area and a long era saw substantive cultural relationships or close similarities from southern British Columbia and eastern Washington into northern Mexico. Very possibly this situation existed from Early Lithic times to about 2000 years ago when horticultural practices began to cause local changes and finally to stimulate extreme innovations in interior western America (the Great Basin, with extensions).

I have no intention of reviewing the evidence which had led culture historians to such considerations as Arid America (Kirchhoff 1954), the old Basin culture as it was called loosely, and finally to the concept of the Desert culture (Jennings and Norbeck 1955). Daugherty has discussed the situation briefly, from the point of view of his work with an early site in Washington (Daugherty 1956a: 94-7; 1956b: 259). Certainly these formulations and discussions are in basic agreement that the Desert culture, as it appears now to be generally called by archaeologists, was widespread and ancient in western America and gave rise to many local developments. Speaking for myself alone, but with the feeling that I would have backing from many other workers, I have no hesitation in extending this ancient culture area much farther north than do Jennings and Norbeck (1955: 7).

Indubitably this culture was an inland one, continentally oriented. It was probably diverse, but nonetheless comprised a valid culture area which had its origin at least as far back as the time of the big game hunters. It was probably consolidating during the Anathermal and during the late Anathermal and the Altithermal began to take on many of the characteristics of the modern (ethnographic) period.

One of these characteristics appears to have been, from the data which we presently command, a population movement toward the rivers and a trend toward a more efficient use of the food resources that they offered. This would be a logical corollary of progressive dessication, and of the withdrawal and extinction, local or otherwise, of food animals. As techniques of exploitation of river food resources were perfected, learned, or invented there would have been, and indeed appears to have been, a slow progressive movement downstream. This appears to have occurred together with a growth of riverine populations, and the two resulted, shortly, in extensive contacts with populations which were either established in estuarine or coastal environments or which began to filter south along the west coast. In many instances, no doubt, inland populations that were moving toward an exploitation of lower river and coastal resources had the field very much to themselves. In other areas, particularly to the north, they may have found the coasts already occupied. Unfortunately, flood and wave destruction and deposition are making and have made it difficult for us to establish the facts as to early estuarine and coastal cultures.

In order to assess the probability of the suggestion made above, it will be necessary to review briefly some of the main facts of western archaeology. There seems to be no doubt that there has been a pattern of increasing adaptation, throughout many parts of the west, to a river and shore oriented hunting and fishing economy.

The concentration of early Pinto and Mojave cultures along watercourses is well known and is not properly a part of this paper. More pertinent to my present purpose is the concentration of the later Yuman peoples along the lower Colorado-Salton Sea region and the development of coastal living populations in southern California and adjacent Mexico. However, I am not sufficiently familiar with the problems of that area to discuss them.

Of perhaps greater pertinence is the sequence that David Banks Rogers (1929) developed for the Santa Barbara area of California. Although Rogers did not have certain modern advantages in his work and there is a serious need of further exploration in that area, he was, however, a sufficiently sophisticated archaeologist to build the results of his work into the time-honored cultural sequence of 3 stages: Oak Grove People (Earliest), Hunting People (Middle) and Canaliño (Late). The first is a gathering culture; the people were not great hunters and they made rather small use of sea products. They lived in semisubterranean pit houses. There was apparently much erosion during this period since metates are found at great depths in outwash debris. Rogers interprets this as a period of rains and storminess; I believe that we would now be more likely to consider it a time of aridity (Antevs 1955). The Hunting People show some use of seed, especially acorn, and of sea shell. Rogers was, however, particularly impressed with the vast amount of animal bones, even

those of large predators, found in the ashy middens of the headland camps. In the next period interest in sea products, until then transitory, develops. Living places of the Canaliño (Chumash) are along brackish marshes, often near the sea. Sea foods, from whale to shellfish, were staples; their middens are heavy, greasy, of high organic content. Their tools, weapons, and art pieces are more perfectly finished; stone and bone manufacture was more skillfully developed. They had seagoing craft; homes were hemispherical jacals. Ceremonial and social life was complex. This was a culture of plenty.

Our best sequence derives from the excavations conducted in the Sacramento Valley and San Francisco Bay areas, primarily by the University of California at Berkeley, the results of which are summarized by Heizer (1949: 37-40). This material shows not only a broad relationship with the Santa Barbara area but also a similar increase in utilization of the lower river and seashore resources. Heizer's calculated dates of 4500 B.P. for the Early horizon, 3500 for the Middle horizon, and 1500 for the beginning of the Late horizon, since validated by radiocarbon determinations, should probably not be transferred directly to the Santa Barbara sequence, but there can be small doubt that there is a close relationship. For the present purposes I am considering that the periods of occupation in both areas do show temporal as well as ecological correspondence. It may well be that the northern Early horizon correlates more closely with the Hunting People of Santa Barbara. Certainly the emphasis upon gathering seems to be weak in the Early Sacramento Valley sites. There is no doubt, however, that by Late times there was much use of sea resources.

Studies in the archaeology of the San Francisco Bay area have been largely those of the great shell mounds that were once numerous there. Most of the recent activities, plus the older, are summarized by Beardsley (1954: 103-7); his statements are in agreement with earlier ones by Heizer (1949: 39). In the same reference Heizer suggests that "the Bay shell mounds may . . . have been occupied by interior peoples and not vice versa [sic]." The artifacts and the fact that the Bay shell mounds are Middle horizon and show no evidence of Early horizon are, it seems to me, indications of a movement out of the interior and a developing interest in the ecological possibilities of an environment that includes the shores of large bodies of water. It is certainly true that the archaeology of the Early horizon is primarily an inland phenomenon and is almost wholly based on the mortuary complex. As we see it now, the Early horizon appears on the scene with its highly evolved and finished artifact types without known antecedents. Beardsley (1954: 104) points out, in this connection, that some of these artifact series, such as the projectile points, the charmstones, and the use of quartz crystals (and he could have added the general way of life), are developed across the continent and southward into South America. He concludes: "While the puzzle of such a distribution cannot be answered at this time, there is at least the certainty that what became California culture did not simply intrude into California from the Southwest, and there is some suggestion that California was touched by a wide dispersal of elements antedating the integration of the Southwestern cultural sphere." My addition to this is that the climatic pressures of, probably, the late Altithermal, if we may base our judgment upon the California dates and Antevs' reconstruction (1955: 322), indicate a very widespread movement from the interior and away from the old interior cultural norms to the western rivers and the coast. It is true that the California dates are late; the climate had begun a fluctuation towards moist and cool, even to lake-forming conditions, about the time of the Early horizon. Perhaps this accelerated the population growth and movement which led to the effect with which this paper is concerned.

The finds reported on by Cressman (1956) in the Klamath Lake area of Oregon are of interest here. Like many parts of the Washington Plateau, the Klamath area had a constant water supply even during the driest times. People there must have been using fish and shellfish, almost as staples, at a very early period. Cressman (1956: 468) states that game was never important after his Level IV which he dates about 7500 B.P. The use of the water lily there led to various specializations and influenced, along with the widespread aridity in the Altithermal, a population concentration in marsh and riverine situations (Cressman 1956: 466).

It appears that the Kalapuya area of Oregon (the Willamette Valley) (Collins 1951) also witnessed a transition from a more thoroughly Plateau (interior) way of life to one that is strongly coastal. I am not sure whether this represents a backlash of coastal influence or is part

of the earlier adaptation with which this paper is concerned.

No small measure of difficulty exists in assessing the evidence which bears on the stated problem from the state of Washington. In the first place, it is probable that there may have been a lag in the development of cultural emphasis on the products of the large rivers, lakes, and oceans. The Plateau has always been better watered than the Basin. Consequently, utilization of the resources available along streams and in lakes or marshes may have always been an aspect of Plateau economy. Thus any changes that took place may have been less abrupt or extreme than those farther south.

The accumulation of Washington data is recent and has been largely controlled by the need for salvage work. Much of it is presently in thesis form, or in unfinished manuscripts, and is thus only partly analyzed and not generally available.

From ethnographic studies it can be pointed out that the people of the Plateau have long lived the sort of life that Ray (1932) describes for the Sanpoil and Nespelem. There was a resistance in the Plateau to the acceptance of sweeping changes from without, although under favorable conditions Salish and Sahaptins alike were able to take full advantage of changes from the outside. The manner in which Plateau cultures on the downstream edges of the Plateau have changed may be partly worked out by archaeological methods. The Wishram, for example, have been able to participate in both coastal (extreme lower Columbia) and inland cultural traditions.

None of the earlier sites excavated in the Plateau has yielded any indication of a culture as strongly river oriented as were the later occupations. Indeed, the burials found on Rabbit Island (N.P.S.-U. of Washington-Washington State Coll. excavations 1951-52) near Pasco on the Middle Columbia, below a caliche layer, are in some ways most reminiscent of the Early horizon of California; extended burials and percussion chipped projectile points with pointed tangs like those illustrated by Heizer (1949, Fig. 12) were found there. Pestles occurred but none of the typical mauls or mallet-pestles were found. Fishing may well have been practiced (the burials were on an island which must have already been an island or a part of the strand of the river when it was used as a cemetery), but no artifacts or remains indicated that fishing was ever practiced (Crabtree 1957). Sites that are presumably later, but which yielded percussion-chipped basalt tools rather than the fine late pressure-chipped cryptocrystalline pieces, bear evidence of extensive use of shellfish and some use of fish. An Early site near Goldendale, excavated by a pipeline crew in the summer of 1956, was well outside of the river valley. It yielded a projectile point similar to those from Lind Coulee (Daugherty 1956, Figs. 19, 20), crude pestles and edge-ground cobbles, all of which indicate a hunting and gathering economy. Caldwell's work at Wakemap (National Park Service-University of Washington excavations in The Dalles reservoir, 1953-54) yielded a sequence of occupation of that large accumulation (Caldwell 1956). He has suggested, on the basis of the finds made in the lower, earlier sections of the mound, his Horizon I, that this was a period of mixed hunting and fishing where many fishing techniques, which he felt had come from downstream, had amalgamated with the older hunting base (1956: 184). He has suggested that the evidence points to a later increasing emphasis on a riverine economy for that section of the lower Columbia.

Cressman's recent work in the region of The Dalles, Oregon, has uncovered a very ancient manifestation with abundant fish bones but an unfortunate lack of artifacts which would indicate fishing practices. The bearing of this find on the present hypothesis is not clear. It now seems to me to suggest the presence of a small, partly water oriented population of an antiquity equal to that of some of the later big game hunters such as Folsom. Perhaps such a culture may have had much to do with the reorientation of Desert culture hunters and gatherers toward a river-sea economy. Cressman has suggested, in commenting on this paper, that our knowledge of the adaptation of such fish as the various anadromous salmon to Glacial and Postglacial river conditions is scanty. These aspects of piscine ecology must be better understood before we can be sure of those applicable to man in the same area.

Swanson, working in caves and open sites near Vantage on the Columbia in the central part of Washington, has developed a local chronology which should be widely applicable in the state. His earlier levels show a lack of, or a very slight interest in, fishing and the use of water resources (the Columbia River), or absence of the remains of such exploitations,

compared with the later levels (Swanson 1956: 186). King (1950) points out that the Cattle Point excavations produced evidence of a change from land to sea oriented economy in the San Juan area. His Island phase is defined as strongly land and hunting oriented; it is sharply differentiated from the later phases, all of which indicate an increasing dependence upon sea products. There is need for further work at Cattle Point and perhaps for a reconsideration of the Island phase, but the broad outline of King's conclusions will probably be maintained. Indeed, Roy Carlson, in a study of the results of excavations other than Cattle Point in the San Juan Islands, found evidence that would substantiate King's conclusions (Carlson 1954).

This brings us finally to the Fraser River Valley, where work and publications by Harlan I. Smith, Franz Boas, Philip Drucker, and Charles E. Borden have also developed the thesis presented in this paper, but overemphasized it to the point where some of us felt it necessary to take issue (Osborne, Caldwell, and Crabtree 1956). We were careful not to reject the theory in toto, however. Its merits, especially as indicated by Borden's work (see Borden 1951 and 1953-54 for a statement and discussion of the question), are too strong for that. Borden has felt that the basis of coastal culture has been primarily interior in character, as I understand him. I have rejected this and believe that such is not the case with either material or social traits, and that the latter indicate a type of influence during later periods that is entirely foreign to the Plateau. I am referring to the great contrast between the aggressive, stratified coastal populations and the unstratified, and sometimes pacifistic older Plateau cultures (see Ray 1939: 24-44, 145-9). I think it is obvious, however, that this is a situation where there is some truth on both sides.

If my summary of what I consider to have been a change of ecological orientation from largely interior hunting and gathering to coastal fishing and gathering, with the implied cultural and populational movements, is correct, then we have here the skeleton of one major phase of Western prehistory. Borden's discovery of the Eskimo-like Early Maritime has indicated that important coastwise movements probably also took place. A meeting and merging of 2 main streams of population and cultural spread have taken place. One, founded on the Desert culture, has an Archaic base, the other stems from the circumpolar zone. Either, and perhaps both, may have included Woodland or proto-Woodland traits. These streams met and blended, and doubtless clashed as well. I have no idea how far south the coastwise thrust reached. It drove deep into California, at least. At any rate, as I see it, interpretations of Western prehistory will now be based on 2 concepts which are at once in accord and in conflict. Perhaps, as I indicated in my opening remarks, such a situation, competition for consideration of 2 conflicting ideas, is healthy for further scientific growth.

Much digging, thinking, and writing must be done before we can understand the time and manner of such movements and their environmental adaptations and readaptations, and before we acquire any feeling for the culture growth and change that were a part of them. To do so is, as I now see it, one of the major duties and pleasures of western prehistorians.

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TWO MASTERPIECES OF MIDDLE AMERICAN BONE SCULPTURE

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TWO magnificent works of art, in the form of carved human bones, have recently been discovered in archaeological excavations in southernmost Mexico. The sculptures are noteworthy for several reasons.

First, they are in themselves masterful works of craftsmanship. Few bone carvings approaching these in composition or technique have ever been found in Middle America. Second, works of art of such quality have not until now been reported from this region of central Chiapas in southern Mexico, an area just beginning to be known archaeologically. Third, the early date makes them all the more interesting, since they are thought to be Protoclassic and therefore the earliest elaborately carved bones yet reported for Middle America. Fourth, the presence of several important art styles combined on the bones makes them important evidence in the reconstruction of Middle American culture history. And fifth, these carved bones add important new data to our knowledge of the content of religious art of this area at this early period.

The bones were found in a tomb in an extensive ruin near the famous old colonial town of Chiapa de Corzo, in the state of Chiapas, southern Mexico. The Pan-American highway to Guatemala runs through the site. It is located on high ground not far from the Río Grijalva which flows from the highlands of Guatemala, through the large valley of central Chiapas, into the Gulf of Mexico. Some 50 structures cover an area of about 1 square mile. Most seem to date from the late Preclassic and Early Classic periods, probably spanning the first 5 centuries after Christ, although still earlier pottery, perhaps as old as 1000 B.C., has been found underlying the architectural remains. The New World Archaeological Foundation has excavated at Chiapa de Corzo for 3 field seasons, to date, during which valuable data have been collected. This article describes briefly a single tomb and the carved bones.

Preparation of the Bones for Study. All who have examined the carvings have found the designs exceedingly complex and difficult to understand on the cylindrical bones. Some method had to be found for "unrolling" the designs, or laying them out flat. Since a satisfactory drawing would be a difficult task, a flexible rubber mold was made which permitted flat plaster casts of the design for study. A latex molding compound was brushed on in 2 coats in the usual manner. Since the bone surface was well preserved, no special treatment was necessary. A technique was developed to avoid bubbles in the plaster cast and assure reproduction of fine detail: very liquid plaster was rubbed onto the mold surface with the finger, and before it set, thick plaster was added in several layers for strength — the plaster was not allowed to reach the mold edges. These layers were allowed to set, then the whole was soaked in water. To build out the edges thick plaster was then applied with the finger, following the exact contour of the mold edge.

In the case of Bone 1, a ridge down one side was not carved. This was safe to choose as the line along which to cut the mold open and to form the borders of the design when spread out. Bone 2, however, presented a problem. The design seemed to be continuous around the cylinder. After careful study, an irregular line following the edges of scrolls and figures was chosen in order to do the least possible violence to the major discernable figures of the pattern. This division seems fairly successful — at least there is no obvious alternative — though certainly the artist never intended the design to be viewed in this way.

The bones of course are not true cylinders, but expanded and contracted and bent slightly in an arc. When the rubber molds were removed from the bones and laid out flat, distortion was inevitable; but it is minor and chiefly at the ends. Each rubber mold yielded a fine reproduction of the carving details, the texture of the bones, and even the cracks, as seen in the photographs of the plaster casts (Fig. 1).

Description. The carved bones are both human femora (upper leg bones). Bone 1 is a left femur, but Bone 2 is harder to identify as left or right because of the carving. We do not really know why human bones were used. They may have been discovered by the artisan in an old burial or they may have come directly from a fresh human sacrifice or slaughtered warrior. Human bones may have been chosen for practical reasons — they are of good quality for carv-

ing, and might have been the largest readily available to the artisans. But some ceremonial meanings associated with a part of a human being certainly seems reasonable.

Both bones are in very good condition. Bone 1 is complete, 23.8 cm. long, with a maximum diameter of 3.7 cm. at one end where it has been cut off square and smoothed. The other end has been cut down to form a plain extension in the form of a round tube 3.1 cm. long and 1.9 cm. in diameter. This probably indicates that the bone was inserted into some other object. Bone 2 is broken at both ends, though the edge along the face appears to be an older break or perhaps a purposeful cut. The bone is now 26.5 cm. long with maximum and minimum diameters of 3.3 and 2.4 cm.

Both bones are carved in very deep relief (up

FIG. 1. The designs of the carved bones from Chiapas; photographs of plaster casts made from rubber molds laid out flat. *a*, Bone 1; *b*, Bone 2.

to 4 mm.) for major design areas. Details are filled in with shallow carving and incising, which is also expertly done. The lines are sure, controlled, and accurately placed, with no errors in planning apparent. Some idea of the method of carving and of the tools used can be inferred from the known assemblage of local artifacts and from evidence on the bones themselves. The main tools were probably stone, since metal is unknown from this early period. The razor sharp, simple prismatic blades struck from obsidian cores are very abundant in the excavations. These were probably the instruments used in the carving and incising. The sawing at the ends of the bones was done with these or other stone blades, or perhaps with a leather thong and wet sand as abrasive. The "eyes" of the mask on Bone 2 must have been drilled with a fine conical drill.

A good polish still remains on raised areas of each bone. The final coating of red, probably hematite, may have been intentional, or it may have been acquired in the tomb, because there was a good deal of this material scattered over the other artifacts and the tomb floor.

Design of Bone 1. The chaos of unintelligible scrolls and small figures on the cylindrical bone was resolved, when laid out flat, into a superb composition (Fig. 1 *a*). In fact so tastefully and carefully planned is the layout that one has the greatest respect for the artist who tackled the problems imposed by the shape of his material.

The over-all layout shows 2 figures, the one below upside down in relation to the one above. In the photograph the upper figure rises out of a wide recurved line that separates the 2 zones. At first glance, the head seems to face left, representing a bird mask with a headdress rising above and falling behind. This interpretation is supported by the similarity of the position of the bird head to that of the other figure on the bone, and has some resemblance to the central Veracruz hachas of later periods (Proskouriakoff 1954, Fig. 3, *hacha 5*; Fig. 11 *c*). However, if the bone is turned on its side, with the "bird" head face down, a serpent is represented — the undershot lower jaw is part of the "bird" face, the upper jaw with teeth and a long down-curved snout is the upper part of the "headdress," and the jaunty decoration over the serpent eye is the lower part of the "headdress." The serpent interpretation is supported by the decoration on the lower jaw of the head on Bone 2, since the "bird beak" would represent a similar decoration of the serpent jaw. This interpretation is further supported, probably proved, by a remarkably similar serpent head on the lower part of Stela 2 at Izapa (Fig. 3 *c*; Stirling 1943, Pl. 49 *b*). The question remains: is the rather obvious bird mask representation a simple accident of interpretation of our untrained eyes, or did the artist, by a cleverly thought-out design, intentionally portray 2 creatures in one, the dual aspects of a single god?

The body of this figure is made up of 2 overlapping discs. Part of each disc is covered with a plaited mat design, the rest being decorated only with vertical parallel lines. The arms are clearly indicated: the right arm is raised, fingers turned downward perhaps to grasp the object below, and the left arm is held lower down, fingers also turned downward near the hand of the lower figure. The face, body, and arms are decorated with double parallel lines. The figure wears bracelets and a necklace. The upper zone is completed by graceful scrolls which fill in the background.

Turning the illustration upside down, the other figure appears. It faces left, with the body in about the same position as the serpent-bird figure. The elaborate mask has a beard. The treatment of the nose and mouth suggests some animal, perhaps a jaguar. The headdress curves backward. Both arms are held exactly as in the serpent-bird figure, but with the palms up. The body consists of 3 overlapping discs. The background band ends in a scroll over the body. The upper left section of this zone is hard to interpret; there are scrolls and other motifs quite distinct from the treatment in the right corner and in corresponding places in the other zone. It may represent a bird head, but it is similar to an element in the upper jaw of the serpent or the bird headdress. The band below the bearded jaw and in back of the head, which could be a collar, is especially interesting for the chevron and scroll motif, followed by 2 hollow rectangles, which are pendant from another band that contains parallel diagonal lines and horizontal lines and ends in a scroll. This complex pattern is duplicated on the other bone and on a carved stone found elsewhere in the temple substructure (Fig. 2 *c*).

If one looks at the cylindrical bone itself and considers the uncarved ridge used to divide the mold simply as part of the background, the 2 figures may form a 2-headed being with one continuous body spiraling around the bone (note that the body discs of both figures overlap along the bone in the same direction instead of being reversed). The decoration is probably the same on both sets of discs, since the arm and the scroll would hide the plaited mat decoration on the body of the bearded figure.

Design of Bone 2. This specimen lacks the formal composition of Bone 1 and is therefore more difficult to describe and interpret. However, as with Bone 1, one's impression is that the design was meant to be viewed with the bone held vertically.

At the top of the bone (as oriented in Fig. 1 *b*) a human face appears along the edge. The face has a pug nose, thick lips, and prominent teeth. A short scroll, perhaps a feather decoration, is pendant from the rear of the jaw. I do not believe this represents the fleshless lower jaw often encountered in Maya art, as the illustration suggests. From the headdress, long free-flowing strands of hair fall over the forehead and to the rear of

the head across the body and left arm. An earplug is represented by the doughnut-like object. The bone may have been purposely cut along the face profile, but the rest of the end of the bone has been broken away. The body consists of a series of 3 overlapping discs. Each disc has a wide border and a decoration like that on the body discs on Bone 1; one disc has 2 circles in the plain zone, reminiscent of a glyph. The figure's right arm, which sprouts from the second disc, is held downwards, palm to the rear. The left arm is raised and the part of the hand still remaining appears under the chin. The face and both arms are decorated with parallel lines as on the other bone. There is a bracelet on each wrist and an oval ornament on the back of the remaining hand. The body appears to end at a scroll pattern which forms part of the background and acts as a zone boundary as in Bone 1.

The second zone is reversed in relation to the first figure, also as in Bone 1. It consists of a mask with a body of 3 discs identical to those in the first figure. However, since the discs overlap in the same direction along the bone as the first figure, this may be a continuation of the first body under the scroll representing a 2-headed being. This lower mask is of particular interest since, although it faces right instead of left, it is essentially a duplicate of the mask on Bone 1. The facial form is the same, though somewhat simplified, but there is no beard, and the headdress differs. Most striking and significant is the complex "collar" design; it is the same as that on Bone 1 and on the carved stone.

The scroll band from part of the background decoration again separates a third major element of the composition — a figure with 4 long feathers (?) superimposed over 4 overlapping discs similar to the bodies on the other figures, although these have a T-motif as decoration. The 4 feathers (?) are very deeply undercut on the left side; this in itself is masterful carving. Three feather streamers are attached to the "mask," and two overlap onto the background area with tassel-like ends. The mask itself, if it may be called such, is of uncertain orientation. It appears to be a top or full-face view, perhaps of a skull. The 2 rows of elements arranged in a semicircle above are most probably upper and lower teeth. The 2 holes below may be eyes or nostrils. The holes are ringed by a faint line, and were apparently drilled from both sides with a tiny conical drill held just off the horizontal so that the holes meet at an angle. The resulting bridge of bone is too fragile to have served for suspension.

The remainder of the bone is filled with a variety of scroll elements and, on the left, what appears to be an isolated tassel. Neither end of the design is complete, but the length of the bone indicates that not very much could be lost. Perhaps the missing part of the bone on the right had a fourth head, making the third figure still another double-headed creature.

The Composition. Over-all interpretations of the designs are made difficult by our lack of large samples of religious art and documentary materials for this early period. In Bone 1, the serpent-bird figure has the arms and hands in what might be called a swimming position. The band below, however, has no specific water symbolism. The bearded figure, with its palms up, could not be interpreted as swimming, but appears to carry out the idea of rising, perhaps from the earth or from clouds (note how the several layers of scrolls from the background overlap onto the bodies in a number of places on both bones). The symbolism might represent an emergence of some sort, though this becomes rather complicated if 2-headed beings are represented. If the background zones do not represent a substance from which the figures emerge, then they might be nothing more than a means of avoiding representation of the lower body parts simply to save space, or merely decoration over the uninteresting central part of the bodies of 2-headed creatures.

The Tomb. The tomb was found deep in the rear of one of the principal temple substructures at Chiapa de Corzo (Mound 1, Tomb 1). On the substructure surface there were 3 low platforms, one on each front corner and one at the rear. The carved stone was found in a sherd dump within one of these front platforms. Although the temple substructure and the platforms are constructed of well-shaped blocks of limestone set in mud mortar over a rock, earth, and trash fill, the tomb itself was built with walls of large unfired mud bricks and a roof of irregular sandstone slabs, apparently laid over wood beams. The tomb measures about 3 m. by 1.5 m. and is 1 m. high. The ancient workmen cut deep into the rear of the building and built the tomb between the walls of earlier enlargements of the substructure. According to G. W. Lowe, who excavated the tomb, it was apparently built at the time of the next-to-last reconstruction, which he assigns to the end of the Protoclassic period. The carved stone was deposited not many years after the tomb was built. There is evidence that the tomb was robbed sometime after its roof collapsed, and this may account for the absence of fine jade ornaments and other jewelry.

Carved Bone 1 was found at the west end of the tomb, lying next to another worked human femur and joined to it by a coat of stucco paint. This bone is also whole, and is almost exactly the same shape and size as Bone 1. Like Bone 1, it has one end carved to fit into a socket. It has been smoothed and polished, but there is no decorative carving whatever. Carved Bone 2 was found near the western end of the south wall of the tomb, associated with another human femur from which the distal end had been cut off square. This bone was polished, but it is otherwise unworked except for a small hole made with a conical drill just above the lesser trochanter. These undecorated bones suggest that they were being prepared for carving, but were never finished. Perhaps the man in the tomb was the artisan.

The skeletal fragments lay scattered along the center of the tomb. It was apparently an extended burial, with the head toward the east. Preliminary examination suggests the remains of a middle-aged or elderly man. A few loose teeth from the upper jaw show moderate wear, but all the teeth from the lower jaw are missing and the bone is resorbed. A burned spear or lance, about 1.25 m. long, was lying along the north wall; charred finger bones by the shaft suggest it was placed in the hand of the corpse at the time of burial. The huge prismatic blade of obsidian, 31 cm. long, has a ground stem where it was fastened to the shaft. The upper part of the shaft and a short cross piece in back of the blade were lined with over 50 shark teeth.

Other outstanding objects in the tomb include a large number of shell ornaments, which may at one time have formed a mosaic, 2 bone earplugs with polished hematite mosaics on one surface of each, a rectangular limestone bowl with 4 short feet, a pearl bead, some jadeite, limestone, and shell beads, and some pottery vessels. There is one elaborate effigy jar: the body of the pot is a ring of clay, surmounted by another tube with an orifice in its top. It is thus a combination of the "doughnut" vessel and stirrup spout. On the front is an animal head, probably a crocodile, with another animal in its mouth. There were also 2 large tetrapod vessels which were covered with stucco painted in red, green, and yellow designs. One is a deep bowl and the other, decorated in Usulután technique and then completely covered with stucco, is an oddly shaped jar with an unbridged spout.

The period represented by the tomb, by the next-to-last rebuilding of the temple substructure, and by the sherd dump where the carved stone was found, is the end of the Protoclassic. Outstanding characteristics are occasional examples of white-rimmed black ware, probably from the southern Gulf coast, stuccoed Usulután ware, perhaps from Guatemala or farther east, and mammiform tetrapod vessels.

Dating. Unfortunately, there is no radiocarbon date for the tomb itself. However, there is a date from a test pit at the Ruiz site farther up the Grijalva River, which Lowe has identified by the pottery as being of the same period as the tomb; the age is 1650 ± 100 years (A.D. 305 ± 100; sample L-286A*). This date is about what would be expected judging by the pottery (see Shook 1956: 29).

Comparisons. Over a long span of time in the cultures of Middle America human long bones, as well as other animal bones, were used as tools and as musical instruments, such as flutes, whistles, and musical rasps. Some of these were decorated by carving or incising. In most cases the worked human bones seem to have had ceremonial significance.

In Middle American bone decoration, the simple technique of incising appears to have been less frequent than carving. The most important incised specimens are some uncomplicated pieces from late horizons in central Mexico (Beyer 1934; Martí 1955) and 2 peccary skulls, incised with elaborate ceremonial scenes, from the Classic period at Copan in Honduras (Longyear 1952).

Carved bones are widely distributed. One of the finest is a statuette carved in the full round from a jaguar femur, showing a Maya priest standing on a pedestal, provenience unknown (Kelemen 1943, Pl. 285 *b*; Caso 1938). In very late horizons in Mexico carved bones, usually done in low relief, have been reported from the Huaxtec culture, from near the coast of eastern Oaxaca, and from the famous Mixtec tomb at Monte Albán (Beyer 1934; Caso 1932: 506; Marquina 1951; Keleman 1943, Pl. 284 *b, c*; Caso 1956; Martí 1955).

Carved bones are also known from Guatemala in the Classic period, at Uaxactun in the lowlands and at Kaminaljuyú in the highlands; some outstanding specimens also come from Copan, Honduras (Kidder 1947; Kidder, Jennings, and Shook 1946; Longyear 1952). A carved bone from the Motagua Valley, eastern Guatemala, has "overlapping ovals, possibly representing belly scales of snake" (Smith and Kidder 1943: 169). While this description is the closest in the literature to the body style on the Chiapas bones, the similarity is probably fortuitous. An animal skull fragment from Copan is carved with a head somewhat similar to the bearded figure on Bone 1 from Chiapas. A small bone spatula, which has scrolls carved on the handle, is the only carved bone earlier than the Chiapas bones; it is from the Middle Preclassic of Kaminaljuyú in the Guatemala highlands (Shook and Kidder 1952: 117, Fig. 53). None of the specimens mentioned above bears any significant similarity to the Chiapas carved bones.

* EDITOR'S NOTE: In a letter of March 4, 1958, J. L. Kulp very kindly supplied the following information. This determination was originally reported as 1700 ± 150 in a letter to T. S. Ferguson, New World Archaeological Foundation, in December, 1955. When dates were assembled for publication in *Science* (Vol. 126, No. 3287, pp. 1324-34, 27 Dec., 1957) the Lamont laboratory recalculated the counting results of this sample, using a slightly different value for "modern" carbon. Therefore, the final adjusted age for sample L-286A was 1650 ± 100 years. When published in *Science* an unfortunate typographical error resulted in this appearing as "1550 ± 100."

FIG. 2. *a*, 4 views of Bone 1; *b*, small Monte Albán I period jar from Monte Negro, Oaxaca, height 18 cm.; *c*, carved stone from Mound 1, 5.2 by 6 cm.; *d*, 4 views of Bone 2; *e*, Danzante 6, Monte Albán, Oaxaca.

FIG. 3. Stelae at Izapa, southeastern Chiapas. *a*, Stela 1; *b*, Stela 6. *c*, detail of Stela 2, showing serpent head at bottom. (Reproduced by courtesy of the National Geographic Magazine.)

Only the low relief pieces from Monte Albán and Copan show as excellent craftsmanship as the bones from Chiapas, while none has their effective combination of deep relief, low relief, and incising. And none surpasses the Chiapas bones in mastery of composition.

The carved bones from Chiapa de Corzo appear to be very different from each other at first glance. However, the design motifs, the manner of carving, the composition, and the style are a good indication that the 2 bones were carved at about the same time and in the same artistic tradition. In fact, there can be little doubt that the same master artisan planned, and perhaps executed, both works of art.

The 2 carved bones from Chiapas belong without question in the general Middle American art style, and there are a number of specific similarities that relate them to several regional art traditions. First, there is a clear relationship with the art style of early periods at Monte Albán, Oaxaca. The face at the top of Bone 2 is remarkably similar to Danzante 6 at Monte Albán (Fig. 2 *e*) in form of face, mouth, earplug, and the hair over the forehead. The face on the bone, however, has a plate below the nose. The bone figures are also similar to other danzantes in the active pose, the position of the arms, and form of hand with long thumb (Fig. 2 *e*, lower left). The Monte Albán figures known as *nadadores* or "swimmers," and which appear on pottery as well as on sculptures, suggest a relationship with the bones. It should be noted that these are not always considered to represent swimmers. (See Caso 1947).

The Olmec-La Venta art style is represented by the plate below the nose on the face at the top of Bone 2. The second mask on Bone 2 and the bearded figure on Bone 1 both have a muzzle development, supraorbital decoration, and eyelike Olmec-La Venta masks which represent the jaguar-monster. This form is also recognizable in the early Monte Albán periods in pottery and is considered to be an Olmec influence in Oaxaca (Fig. 2 *b*). What I have called the pendant hollow rectangle on the bones and carved stone also is common in Olmec-La Venta art (Drucker 1952; Thompson 1943: 111, Fig. *a*).

The bodies which consist of overlapping discs and have plaited mat decoration are similar to a series of overlapping mat-decorated discs on Stela 1 at Piedra Labrada (Blom and La Farge 1926: Vol. 1, Fig. 38; Coe 1957, Fig. 2). While this monument may not conform to the Olmec-La Venta style, it is from the Olmec-La Venta area. The comparison with the Chiapas bones, if significant, would tend to confirm Coe's view that the stela is early.

Specific comparisons can also be made with the art style represented on the stone monuments at Izapa, in southeastern Chiapas. The "collar" design on the bones and carved stone is very similar to what Stirling has interpreted as a highly conventionalized jaguar mask panel, and there are also scrolls outlined with a single line (Fig. 3 *a*; see Stirling 1943: 62, Pls. 49 *a*, 51 *a*, 53 *a*, 54, 57 *a*; Orellana 1955, Fig. 2). The hand form, the faint oval decoration on the hand, and the bracelet on Stela 6 (Fig. 3 *b*; Stirling 1943, Pl. 50 *b*) are similar to the hand on Bone 2. The serpent head on Bone 1 and that on Stela 2 at Izapa (Fig. 3 *c*) are remarkably alike. And on Stelae 1 and 11 (Fig. 3 *a*; Stirling 1943, Pls. 49 *a*, 53 *a*) there are 2-headed monsters, very reminiscent of the second head on Bone 2. Water symbolism is clearly indicated on Stela 1.

There are also some similarities to Classic Maya art, such as the tendency to cover all available space with some decoration, the 2-headed monster concept (?), the occasional use of the outlined scroll, and the serpent head representation (Proskouriakoff 1950). These comparisons are all on a relatively general level and, significantly, are also characteristic of Izapa art as well. Proskouriakoff (1950: 183) points out that the stelae at Izapa seem to "form a link between the Maya style, the style of La Venta, and that of Monte Alban."

Another similarity, somewhat vaguer than the preceding ones, may be seen in the classic Veracruz art style, where the scrolls outlined with a single line recall the scrolls on the Chiapas bones (Proskouriakoff 1954). An especially interesting comparison on a more abstract level was expressed by Proskouriakoff (personal communication), who points out that "the idea of interlacing two contrasting kinds of design, the ornamental scroll and the representative figure, is characteristic of Classic Veracruz alone" among previously known Middle American art styles. Thus, the Veracruz style and the Chiapas bones may have shared in a common artistic tradition. On the other hand, it is possible that the scrolls on the Chiapas bones may be interpreted as an integral part of the symbolic or representational content of the composition, which would contrast strongly with the abstract,

decorative, space-filling use of scrolls which is the rule in the Classic Veracruz style.

Conclusions. Aside from their intrinsic importance simply as works of art, the carved bones from Chiapa de Corzo have considerable archaeological importance since they combine elements of at least 3 interrelated art styles, early Monte Albán, Olmec-La Venta, and Izapa. As has been discussed by others, the Monte Albán and Olmec-La Venta styles form a complex reaching across the Isthmus of Tehuantepec, and stretching through southern Chiapas and southern Guatemala, where they are often combined with the Izapa style. As Coe (1957) suggests, the Izapa style may be somewhat later (Protoclassic) than the Monte Albán and Olmec-La Venta diffusion. This conforms to the date for the bones and carved stone. It would seem, then, that at least some of the Izapa art is a regional tradition which was strongly influenced by the early styles of Oaxaca and the southern Gulf coast.

In conclusion, the best interpretation for the carved bones is that they represent the nonmonumental aspect of Monte Albán- and Olmec-influenced Izapa sculptural art in the Protoclassic period. They are thus of fundamental importance in broadening and making more precise the definition of the style. It remains to be seen how strongly the Izapa style is represented in central Chiapas, how it was manifested in other art media, what was the exact nature of the Monte Albán and Olmec-La Venta influence, how the Izapa art tradition itself evolved, and what was the role of the Izapa style in the subsequent developments of Middle American art, especially that of the Classic Maya.

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NEW WORLD ARCHAEOLOGICAL FOUNDATION
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THE ARCHAEOLOGY OF THE LENA BASIN AND ITS NEW WORLD RELATIONSHIPS, PART II

PAUL TOLSTOY

DIFFUSION: CONCRETE PROBLEMS

A CONSIDERATION of the Siberian data by anyone acquainted, albeit summarily, with the major themes of North American prehistory, cannot fail to lead to the formulation of a number of specific problems relating to prehistoric contacts between the Old World and the New and their effect on culture development on both continents. The limitations of available data, time, space, and competence alike set limits to the degree to which they may be fruitfully explored here. Yet it seems worthwhile at least to list the more obvious ones and to comment on them briefly, thereby suggesting directions for future investigation. These problems may be grouped under the following topic headings:

1. Evidence suggestive of diffusion from Asia on the earliest levels of occupation in North America.

2. The apparent priority of the bifacial projectile point tradition in North America.

3. Lithic traits that may be earlier in the American Arctic than in the Lena Basin, a number of which appear to derive from the early bison-hunting complexes of the North American Plains.

4. Rather extensive similarities in nonceramic inventories between the Lena Neolithic and the Archaic and earlier Woodland cultures of the eastern United States, and particularly the Late Archaic of the Northeast.

5. Numerous resemblances between Neolithic and Early Bronze pottery in the Lena Basin and Early and Middle Woodland ceramics in eastern North America.

6. The apparently numerous contributions of Lena Basin cultures to the cultural fund of the American Arctic and Northwest, many of which also come under preceding headings.

1 and 2. Beyond the few statements made at the beginning of this survey, we have little to contribute to the first 2 problems, other than their mere formulation. Generally speaking, there is every reason to suspect that the earliest New World industries, like their originators, commenced in Asia. It is, therefore, with the Yeniseyan scraper and chopper industries, or the even earlier Mal'ta-Buret' small flake assemblages, neither of which has been described in this paper, that similarities are to be expected. Any number of common American scraper or other flake, uniface, or crude biface tool forms and, no doubt, some types of bone implements, may therefore have been introduced from Siberia between the time of the original population of the New World and, roughly, 5000 B.C. More doubtful are such traits as the pithouse, known in both Paleolithic horizons of Siberia, but only inferred to be very early in the New World (Daifuku 1952), the use of red ocher as a burial accompaniment, and the lamellar flake complex. The latter was "available for export" in the climatically cold period represented by sites of the upper (15 m. to 18 m.) Yenisey terrace, but indisputable early evidence from the New World is lacking, the absolute dating of Iztapan and Denbigh alike being more than ordinarily in doubt. At present, it seems advisable to relegate this feature to our fourth topic heading.

In sum, the body of evidence for diffusion on either the basic or the early paleo-Indian (Interglacial, Glacial, and Anathermal) time levels should probably be sought through a painstaking typological analysis of the more widespread and, in a local framework, least distinctive American chipped stone artifacts, notably scrapers, and an attempt to identify some of them in the earliest assemblages of North America, preferably disassociated from bifacial point forms. It is worth pointing out, however, that Paleolithic remains have yet to be found in the Siberian Arctic. Latest published information (Okladnikov 1955b, Fig. 1) indicated that none had been found north of Yakutsk.

As for paleo-Indian point forms, it can only be repeated here that the negative evidence from Siberia is by now obtrusive enough to raise serious doubts as to their derivation from Asian prototypes. There seems to be every indication that eastern Siberia as a whole was lagging behind North America in glacial and epiglacial times in the technology of bifacially chipped projectile points. Yet, the possibility should perhaps be left open that the unique laurel-leaf forms of Verkholenskaya Gora, and similar

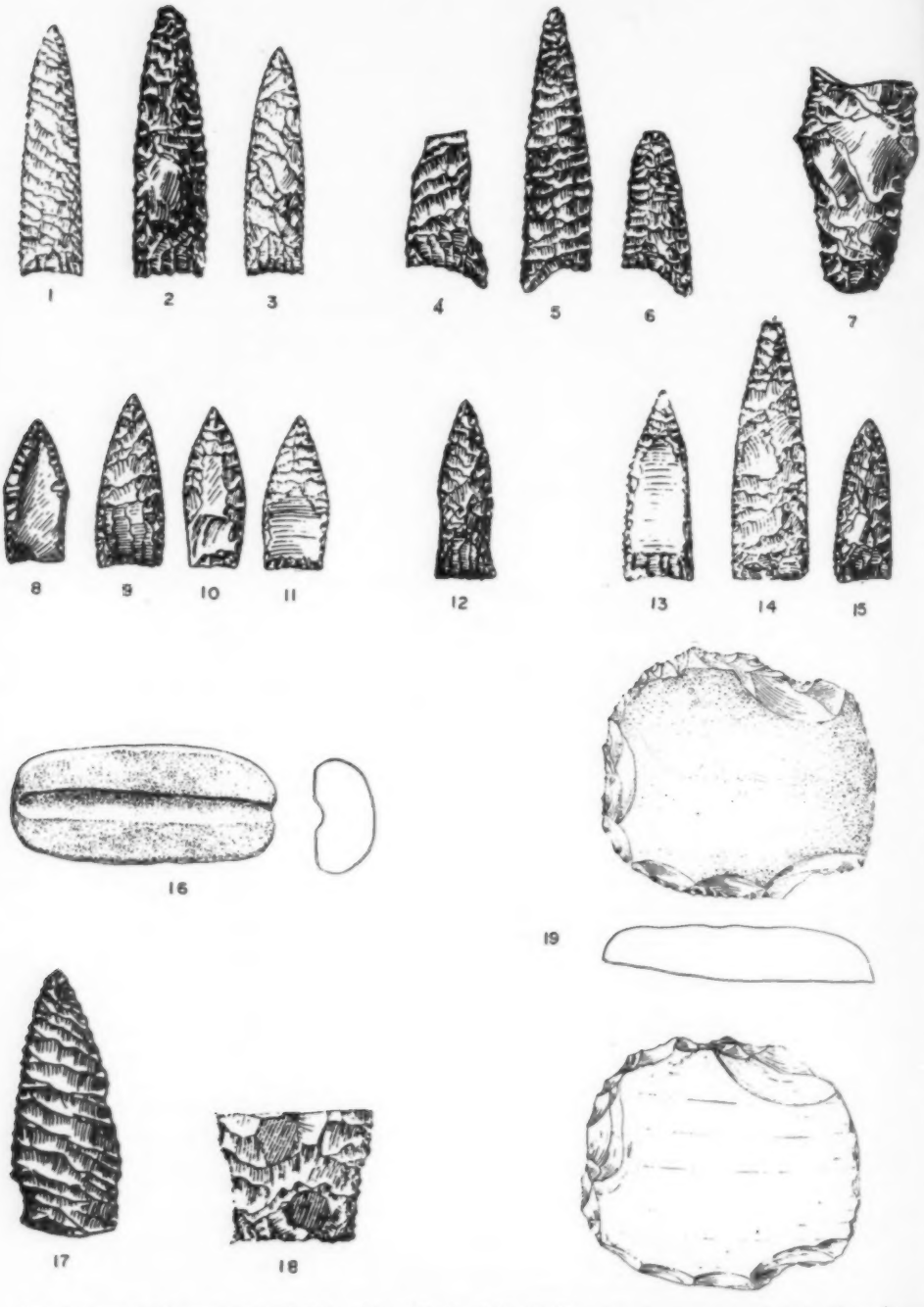

FIG. 1. Some lithic types of the Baikal and Lena Basin. 1-15, 17, 18, points (approx. natural size); 16, sandstone shaft straightener (approx. ½ size); 19, boulder-chip scraper (approx. ½ size). 1, 3, 8-15, Glazkovo (after Okladnikov 1955a, Figs. 18, 99, 100); 7, Kullaty III; 4-6, 17, Kullaty II; 2, Kullaty I (after Okladnikov 1950b, Pls. 11, 29, 32); 18, Uolba, lower level (after Okladnikov 1946, Pl. 5); 16, 19, Kitoi (after Okladnikov 1950a, Figs. 107, 108).

forms which are apparently somewhat more common in Trans-Baikalia (the so-called Selenga culture) go back considerably earlier than the dawn of the Neolithic around 5000 B.C., to which they are generally considered close in time.

3. In connection with the apparent lag of projectile point technology in northeastern Asia, it seems appropriate to recapitulate briefly the Siberian evidence. From the earliest Neolithic period of the Baikal (the Khin'skaya), 2 bifacial point specimens have been reported. They are outnumbered, however, by partially retouched, lamellar, tanged and untanged Swiderian-like forms. The latter apparently persist through Isakovo to Serovo, but are largely replaced in that interval by relatively squat bifacial asymmetric concave-base and symmetric stemmed ("Gary-like") types. Oblique parallel flaking is first evident in Serovo, on long lanceolate knives or spear points, and represented in later stages. By Glazkovo times, long lanceolate (Fig. 1, *1*, 3), short lanceolate (Fig. 1, *8-11*), elongate fishtail (Fig. 1, *12*) and elongate pentagonal (Fig. 1, *13-15*) points are known. The first may go back to Kitoi times, the second are perhaps in use as early as Serovo. Many of these points in Glazkovo have multiple flake scars or channelings caused by basal thinning (compare also Okladnikov 1955a, Figs. 99-100), and some of the short lanceolate specimens have a flake scar over most of one visible face. The long lanceolate points are sometimes diagonally parallel flaked. All 4 varieties resemble some paleo-Indian forms of the North American Plains, particularly the Plainview and Angostura types (Sellards 1952, Figs. 30, 31, 32, 36; Suhm and Krieger 1954, Pl. 80), though they are only about half their size.

In the same time interval (Serovo to Glazkovo) that sees the appearance of these new point types and characteristics, 3 other innovations are noted in the Baikal sequence: the flat, rounded boulder-chip skin scraper (the tci-tho of the American Northwest) (Fig. 1, *19*), bifacial lunate side-blades (side-blades before Kitoi are rectangular) and paired sandstone shaft straighteners ("smoothers"), frequent in Kitoi, but known from one Serovo example. The first and last named occur in the Scottsbluff level of the MacHaffie site in Montana (Forbis and Sperry 1952: 130).

That the distribution of these features to the north in the Lena valley is spotty must be due largely to deficiencies in the record. However, diagonal parallel flaking and perhaps the sandstone shaft straightener are known on a comparable time level at Kullaty. Basal thinning occurs on points from Kullaty I, though no unimpeachable examples occur in Levels II and III. Angostura-like points are known from Kullaty I (Fig. 2, *2*) and probably II (Okladnikov 1950b, Pl. 29, *11*). In addition, 2 Denbigh-like forms occur in the Kullaty Neolithic: an elongate parallel flaked type with an asymmetric spur, also found at Khatanga, and not unlike some Denbigh and Ipiutak specimens (Fig. 1, *4-6*; Giddings 1951, Fig. 61a, *8-10*); and a distinctive long-stemmed point similar to specimens known from Anaktuvuk and the Firth River (Fig. 1, *7*; Irving 1951: 52; MacNeish 1956a, Pl. 3, 3). Finally, a diagonally flaked point with a slightly inset stem from Kullaty II (Fig. 1, *17*) can be compared to some known Scottsbluff examples (Forbis and Sperry 1952, Fig. 62, *1-4*).

In the Siberian Arctic, diagonal ripple flaking, Angostura-like points and perhaps the tci-tho scraper may be assigned as early a date as elsewhere in the Lena Basin. A fragment of a Scottsbluff-like point with an indented base (Fig. 1, *18*) has been illustrated for the lower level at Uolba. The context in which these examples occur differs, however, from that in the Baikal in consisting predominantly of lamellar flakes (microblades), which persist much later in the Arctic and Middle Lena than further south. Angostura-like points have been found with lamellar flakes on the Chukchee Peninsula at Yakitikiveem.

Now, diagonal parallel flaking, basally thinned Plainview-like points, elongate Angostura-like points, Scottsbluff-like points with indented stems, elongate asymmetric spurred points, the long-stemmed point, lunate side-blades, microblades, and the sandstone shaft-straightener cluster rather remarkably in Arctic North America in assemblages such as Denbigh, Anaktuvuk, and New Mountain, noted for their bicontinental affinities. A radiocarbon "stop-date" of 3500 to 2500 B.C. has been given for Denbigh (Giddings 1955), while the related Trail Creek site is dated at about 4000 B.C. These figures in themselves, whatever the possibly earlier correct date for Denbigh, suggest that most of the elements under discussion are present in the

TABLE 1. SOME NONCERAMIC TRAITS SHARED BY CULTURES OF THE LENA BASIN AND NORTHWESTERN NORTH AMERICA.

Left-hand column, earliest occurrences in the Baikal, with dates for periods; *italics* indicate traits that may be earlier than here indicated. Second and 3rd columns, recorded occurrences of these traits in the Middle Lena and Siberian Arctic areas; all are Neolithic, but precise dates uncertain. Occurrences reported for the American Arctic and Northwest areas are divided into (left) those probably old enough to reflect or actually represent *diffusion* between Asia and America, and (right) those presumed to be "relicts" *surviving* in more recent cultures, with older evidence lacking. No attempt is made to cite complete distributions of these relicts, and occurrences are here selected that are most suggestive of time-depth, Plateau occurrences being preferable to Eskimo, and of Eskimo occurrences Ipiutak being avoided as possibly representing a late and limited penetration of Asian culture into Alaska (Larsen and Rainey 1948: 157). Right-hand column, Eastern North American occurrences, with oldest to left, younger to right; *italics* indicate extensive distributions in space and time, none being dated (to the writer's knowledge) earlier than the entry cited.

	Baikal	Middle Lena	Siberian Arctic	American Arctic and Northwest "*Diffused*"	American Arctic and Northwest "*Survived*"	Eastern North America (*Oldest Occurrences at Left*)
BEFORE 4000 B.C.	Prismatic cores and flakes	x	x	Flint Creek[1]		Mattawan, Ont.[26] Frontenac?[27]
	Casual-flake burins	x		Flint Creek[1]		Virginia[25]
	Tear-drop shaped points	x	x	Flint Creek[1]		*Lamoka*[28]
ISAKOVO 4000–3000 B.C.	*Pyriform pendants*				Plateau[2]	Frontenac[29]
	Squat asymmetric point	x	x			North Beach[31]
	Stemmed "Gary-like" point		x	Firth River Corded[3]		*Red Paint*[32]
	Bifacial rectangular side-blades	x	x	New Mountain[4]		Frontenac?[33]
	Petaloid-triangular ground adze				Kachemak I[5]	*Laurentian*[34]
	Short gouge					*Frontenac*[35]
	Burial covered or outlined with stones				Plateau[6]	Frontenac[36]
	Above-ground dwellings	x	x		Plateau?[7]	(Inferred for Archaic of Northeast) Adena[37]
SEROVO 3000–2500 B.C.	*Plano-convex adz*				Ipiutak[8]	*Lamoka*[38]
	Quadrangular adz				Plateau[9]	*Lamoka*[39]
	Notched-pebble sinkers	x		Tlaltheilei?[10]		*Lamoka*[40]
	Fish effigies (stone)				Alaska[11]	Red Paint[41]
	Compound fishhook shank (stone)				Thule[12]	New England[42]
	"Male" harpoon	x	x		Plateau[13]	*Lamoka*[43]
	Squat lozenge point			Firth River Corded[14]		*Late Archaic*[44]
	Truncated lozenge point			Firth River Corded[15]		*Grassy Island*[45]
	Erratic lobate point					Crab Orchard, Ill.[46]

	Truncated lozenge point		Firth River Corded[15]		*Grassy Island*[45]
KITOI 2500–1700 B.C.	Erratic lobate point				Crab Orchard, Ill.[46]
	Beveled adz		Ipiutak[16]	*Lamoka*[47]	
	Ground stone "man's knife"		Okvik[17]		New Hampshire[48]
	Smooth-edge saw		Kachemak II[18]		Poverty Point[49]
	Bone dagger with condyle hilt		Eskimo[19]	*Lamoka*[50]	
	Beaver incisor tool		Eskimo[20]	*Lamoka*[51]	New England[52]
	Bone whistle	x	Plateau[21]	*Lamoka*[53]	
	Panpipes				Hopewell[54]
	Dog burial, separate			*Lamoka*[55]	
GLAZKOVO 1700–1300 B.C.	Prone burial			Frontenac[56]	
	Asymmetric ovate chipped knife[22]	x	Early Aleut[23]	*Frontenac*[57]	
	Bone or antler spoons		Plateau[24]	*Frontenac*[58]	
	Combs		Plateau[25]	*Frontenac*[59]	

SOURCES FOR ENTRIES IN TABLE 1.

[1] MacNeish 1956a: 96.
[2] Collier and others 1942, Pl. 10 *h*.
[3] MacNeish 1956a, Pl. 3, *4*.
[4] MacNeish 1956a, Pl. 2, *28*.
[5] De Laguna 1934, Pl. 19, *11*.
[6] Collier and others 1942: 39.
[7] Collier and others 1942: 114.
[8] Larsen and Rainey 1948, Pls. 10, *4, 5*; 47, *7*.
[9] Collier and others 1942, Pl. 15 *a-c, f*.
[10] MacNeish 1951: 38.
[11] Rau 1884, Fig. 350.
[12] Mathiassen 1930, Pl. 4, *5*.
[13] Collier and others 1942, Pl. 9 *h-j*.
[14] MacNeish 1956a, Pl. 3, *7, 9*.
[15] MacNeish 1956a, Pl. 3, *6*.
[16] Larsen and Rainey 1948, Pl. 47, *6*.
[17] Rainey 1941, Fig. 31, *1-3*.
[18] De Laguna 1934, Pl. 22, *1-5*.
[19] Murdoch 1892, Figs. 174-5.
[20] Nelson 1899, Pl. 38.
[21] Collier and others 1942, Pl. 9 *m*.
[22] This form, illustrated specifically only for Glazkovo (Okladnikov 1955a, Figs. 25-7), should perhaps be identified typologically with the semilunar knife, known as early as Kitoi, from which it differs only in the pronounced curvature of *both* edges, though one is less curved than the other. Such an identification would entail that of Eskimo, Aleut, Plateau, Northeastern, and Poverty Point forms as "chipped ulus," thus transferring this latter entry from Table 3 to this table.
[23] Martin and others 1947, Fig. 118 *j*.
[24] Collier and others 1942: 87.
[25] Collier and others 1942, Pl. 10 *e*.
[26] Ridley 1954: 43, Fig. 17 *o-w, z-cc*.
[27] Ritchie 1944, Pl. 147, *57-8*.
[28] Muller 1956.
[29] Ritchie 1944, Pl. 154, *24-5*.
[30] Ritchie 1944, Pl. 152, *20-1*.
[31] Smith 1950, Pl. 14, *27*.
[32] Moorehead 1922, Fig. 48.
[33] Ritchie 1944, Pl. 147, *84*.
[34] Ritchie 1944, Pl. 123, *10*.
[35] Ritchie 1944, Pl. 148, *8*.
[36] Ritchie, Pl. 125.
[37] Webb and Snow 1945: 52-9.
[38] Ritchie 1944, Pl. 154, *41-2, 48*.
[39] Ritchie 1944, Pl. 154, *40, 46*.
[40] Ritchie, Pl. 155, *12*.
[41] Moorehead 1922, Fig. 39; Willoughby 1935, Fig. 29.
[42] Willoughby 1935, Fig. 121 *r, s*.
[43] Ritchie 1944, Pl. 160, *9*.
[44] Bullen 1948: 46, Fig. 7.
[45] Johnson and Raup 1947, Pl. 2, *18*.
[46] Maxwell 1952, Fig. 97, *19*.
[47] Ritchie 1944, Pl. 154, *43, 49*.
[48] Willoughby 1935, Fig. 35.
[49] Ford and Webb 1956, Fig. 34 *h, i*.
[50] Ritchie 1944, Pl. 159, *23*.
[51] Ritchie 1944, Pl. 160, *19-23*.
[52] Willoughby 1935: 275.
[53] Ritchie 1944, Pl. 160, *12-13*.
[54] Martin and others 1947, Fig. 82.
[55] Ritchie 1944: 296.
[56] Ritchie 1944: 385.
[57] Ritchie 1944, Pl. 146, *61*.
[58] Ritchie 1944, Pl. 151, *26*.
[59] Ritchie 1944, Pl. 152, *13*.

American Arctic as early as if not earlier than their earliest reported occurrences in the Lena Basin. More significant is the fact, already documented at some length, that many of them occur at paleo-Indian sites in the Plains of North America which, in all probability, should not be dated any later than 5000 B.C. and, in some cases, may well be earlier. The tci-tho scraper, as already pointed out, may be added to the list on the strength of its early occurrence in the Plains, as well as its extensive distribution in the Northwest (De Laguna 1934, Pl. 20; Collier, Hudson, and Ford 1942, Pl. 6), though it has apparently not been identified at Denbigh or in related complexes.

The patent Old World relationships of Denbigh and similar assemblages of the American Arctic must certainly indicate communication between the 2 continents. As Giddings has pointed out (1952: 100), communication across Bering Strait can be expected to be reciprocal as a matter of course. There seems to be no valid reason why this should not have been so in Denbigh times.

Like MacNeish, we are thus visualizing the movement of certain paleo-Indian culture elements out of the Plains (a movement which some would correlate with the "Long Drought") as not only an eastward, but also a northward drift (MacNeish 1956b: 74). In addition, we are suggesting that some of them carried over, perhaps through the intermediary of a Denbigh-like culture (whence the late appearance of lunate side-blades, long-stemmed and spurred points in the Lena Basin), into the Siberian Arctic, to eventually appear about 2500 or 3000 B.C., at the earliest, in the Baikal sequence. Of the 2 alternatives considered by MacNeish (1956a: 97) to explain the association of lamellar flakes, burins, Angostura-like, and Plainview-like points in the Flint Creek assemblage of the Firth River, we are thus inclined to favor the second, namely, that it is "the result of a fusion of a complex with Angostura points that had long been established in the New World with a complex of tools . . . that more recently spread to the New World from Asia." Extending this interpretation to other finds of the American Arctic and Subarctic, it seems even possible to see MacNeish's Artillery Lake (1951), Sandy Lake (1954), Franklin Tanks, and Great Bear (1956b) complexes as representing a relatively unadulterated "native" lithic tradition in its northward and westward progress toward Asia, and Trail Creek, Anaktuvuk, Denbigh, N. T. Docks, Pointed Mountain, and Mattawan in Ontario (Ridley 1954) as reflecting varying degrees of fusion with the lamellar and burin-using tradition intruding from Siberia. This fusion process should probably be thought of as taking place over a long period of time, with locally varying results, in a broad Arctic and Subarctic zone including portions of both the Old World and the New, and involving a series of related and communicating cultures, of which only a few archaeological representatives are at hand.

It must be kept in mind, however, that the phase preceding this blend has not yet been identified in Asia. Typologically and chronologically, the earliest remains of the Siberian Arctic already fall into the period for which we are postulating contacts with North America. The Khin'skaya period of the Baikal, however, appears to fit well the specifications of such a phase, and there is little reason to doubt that some similar manifestation will be identified eventually further north.

Finally, it should be made clear that our hypothesis of cultural interchange between the 2 continents for which there is evidence perhaps as early as 4000 B.C. in the Bering Strait region is not designed to account for any specific traits known in the Baikal before 3000 B.C. The ultimate derivation of the bifacial projectile points current 1000 or 2000 years earlier in Isakovo, Khin'skaya, and terminal Paleolithic inventories therefore remains a problem which, for the moment, defeats speculation. Their known analogues in North America seem later, not earlier, and they therefore belong, in our discussion, with the group of traits to be examined next.

4. This brings us to a relatively long list of Amerasian correspondences (Table 1) whose implications are somewhat less controversial. We seem to be dealing with similarities that can generally be accounted for by diffusion from Asia. The earliest appearance in the Baikal of the traits in question ranges from the Paleolithic to the Glazkovo periods and, in the eastern United States and Canada, from Early Archaic to Middle Woodland. By and large, however, they are represented by late Serovo and Kitoi times in the Baikal (3rd millennium B.C.) and

need not be dated, in many cases, earlier than Late Archaic in northeastern North America.

Table 1 calls for a number of comments. The 3 major columns or divisions represent, in our estimation, time-space units commensurate with the scale of the problem, and the quality of the information at hand. The problem is admittedly broad and the information barely passable. The list of similarities given seems impressive enough, nevertheless, to suggest culture flow between northern Asia and northeastern North America in Archaic and Early Woodland times. Similarly suggestive is the fact, not apparent from the table, that the traits involved are, for the most part, either absent or late in the southeastern United States, Prairie, Plains, Southwest, and California areas.

Inverting our perspective for a moment, it is enlightening to view Table 1 as a commentary on the state of our knowledge of the sequences concerned and, in particular, of intervening areas. It seems significant, for example, that the most convincing distributions involve traits of chipped stone and particularly point forms, since they belong to artifact classes that are both numerous when in use and always preserved when abandoned. The majority of the culture elements considered in Table 1, nevertheless, occur in the Northwest too late and too far off the direct diffusional track with which we are concerned. In addition, a large number are not reported from the Middle or Lower Lena and, if reported, are not necessarily early enough there. The correlation of these absences with the embryonic state of non-Eskimo archaeology in the Arctic and Subarctic of both continents hardly needs demonstration. The few traits that seem entirely absent from the American Northwest are restricted in distribution or rare in the Baikal and/or the American Northeast.

Some of the Amerasian traits in Lamoka might be construed as earlier in North America than in Asia. This may imply incorrect maximal dating in Asia or minimal dating in America, or greater antiquity in intervening areas of Asia or America. The facts that culture elements cannot be pinpointed within the apparently long time span of Lamoka and that, as a diffusional source, the Pacific coast of Siberia is unexplored, should be kept in mind. An ever-present possibility is that some of the comparisons may not stand up under closer typological scrutiny. Finally, future finds may transfer some of the entries to the group of traits examined under our third heading. This consideration is already implicit in our omission from Table 1 of elongate-pentagonal, fishtail, long-stemmed, and lanceolate point forms shared by the Baikal and some Archaic and Woodland manifestations in eastern North America, on the assumption that, if some of the suggestions made earlier are correct, these similarities represent a shared background, rather than direct diffusion. In actual fact, the 2 alternatives are probably not so clear-cut, since the entire area from the southern Plains to the Siberian taiga, and the entire time interval from paleo-Indian in North America to the dawn of the bronze age in northern Asia is a potential reservoir for such traits in the eastern United States, and only future investigation can hope to determine their ultimate derivation in any specific instance.

There can be little doubt, generally speaking, that future work will entail extensive revisions of the proposals implicit in Table 1. Amplification of our knowledge will, no doubt, permit the marshaling of more relevant evidence for the American Northwest. Additional comparative work should clarify the Amerasian status of such traits as bird-bone tubes which, in the Northeast, have so far never been interpreted as needle-cases; of the subrectangular slate knives of the Baikal and Lower Lena, which may or may not be related to the New World ulu; of knobbed woodworking tools, which may or may not constitute a valid typological label to include some Red Paint gouges and an adz described and illustrated by Okladnikov for the Lower Lena (Okladnikov 1947c); of squat triangular points with straight bases; of incipient-stemmed points such as that represented by a specimen from the Khin'skaya period of the Baikal; of carved wooden or bone pointed-head human effigies such as occur in Glazkovo (Okladnikov 1955a, Figs. 141, 142, 144), Kullaty I (Okladnikov 1955a, Fig. 143), and among the Eskimo and Huron (Rainey 1941, Figs. 28-30; Kidd 1952, Fig. 27 *f*); of the ax as opposed to the adz; and doubtless of many other elements we have not even considered here. No claims should probably be made at present for any of these, and some of the claims we have chosen to formalize in Table 1 may have to be withdrawn in the future. However, our basic thesis is unlikely to be affected thereby: that, while disseminated at times somewhat erratically, and always fitted into the distinctive pat-

TABLE 2. SOME CERAMIC TRAITS SHARED BY CULTURES OF THE LENA BASIN AND EASTERN NORTH AMERICA.

Except as specified, American entries refer to cultures of the "Early Woodland" type.

TRAIT	BAIKAL	MIDDLE LENA	LOWER LENA-ARCTIC	AMERICAN ARCTIC *Early*	AMERICAN ARCTIC *"Relict"*	MIDDLE WEST	NORTH-EAST	MIDDLE ATLANTIC	SOUTH *(Early)*	SOUTH *(Later)*	MIDDLE WOODLAND
Lump-modeling	Isakovo	?	?	Firth River Cord-Marked		?	?	x	x		
Granular temper	Isakovo	Bestyakh	Syalakh	Firth River Cord-Marked		x	x	x		x	
Net impression	Isakovo	Bestyakh	Syalakh			x	x	x			
Complete or near-perforation of rim as decoration	Isakovo*	Bestyakh	Syalakh			x		x			
Conoidal base	Isakovo	Kullaty		Firth River Cord-Marked		x	x	x		x	
Coiling	Serovo		Uolba I	Firth River Dentate		x	x	x		x	
Fabric impression	Serovo	Kullaty			Point Hope	x	x	x		x	
Cord marking	Serovo	Kullaty	Uolba I	Firth River Cord-Marked		x	x	x		x	
Linear stamping	Serovo	Turukta	Uolba I	Firth River Grooved		x		x	x	x	
Quadrangular-tooth dentate stamping	Serovo	Kullaty?	Syalakh	Firth River Dentate		x	x		x	x	
Linear punctation	Serovo								x	x	Laurel
Maggot dentate stamping	Serovo										Hopewell
Crescent dentate	Serovo										Hopewell
Nodes punched from inside	Serovo			Firth River Grooved				x		x	
Lip notching	Serovo	Kullaty	?		Ahteut	x	x	x		x	
Crosshatch incision	Serovo	Turukta									Hopewell
Rounded base	Serovo	Turukta	Uolba II (may be earlier)		Barrow	x	x	x	x	x	
Lugs	Serovo				Kukulik	x		x	x		
Crack lacing	Serovo	Kullaty	Uolba I	Firth River Cord-Marked		x	x	x	x	x	
Cord impression	Late Neolithic	Mumky?									

Crack lacing	Serovo	Kullaty	Uolba I	Firth River Cord-Marked		x	x	x	x	x	
Cord impression	Late Neolithic or Early Bronze	Munku?				x			x	x	
Cord-wrapped stick stamp	Glazkovo (may be earlier)				Igloo Pt., Woolley	x	x	x		x	
Fiber temper	(not reported)	Ymyiakhtakh	Uolba I	Firth River Cord-Marked?					x	x	
Clay temper	(not reported)	Ymyiakhtakh	Uolba II			x		x		x	
Check stamping	(not reported)†	Ymyiakhtakh	Uolba II	Firth River Grooved horizon						x	
Linear check stamping	(not reported)	Ymyiakhtakh								x	
Bold check stamping	(not reported)		Uolba II		Nunivak					x	
Rhombic check stamping	(not reported)		Uolba II							x	
Triangular-tooth dentate stamping	(not reported)	Kullaty	Early Bronze	Firth River Dentate?					x		Hopewell, Laurel, Rose (Mass.)
Bird motif	(not reported)	Ymyiakhtakh?									Hopewell
Worked sherds	(not reported)	Kullaty						x			

* Complete perforation of rim is not specifically reported before Serovo. On the Middle and Lower Lena, perforation is usually complete, but is like Isakovo deep punctation at Barbatchiki, probably comparable to Kullaty in age.

† Check-stamping occurs in Trans-Baikalia, where it may be Glazkovo or Shyvera in date. (Okladnikov 1955a: 199-200.)

Sources for North America:

Arctic: Early: MacNeish 1956a, and personal communication. "Relicts": Oswalt 1955.
Northeast: MacNeish 1952; Ritchie and MacNeish 1949; Smith 1950.
Middle Atlantic: Coe 1952; Evans 1955; Manson 1948; Schmitt 1952.
Middle West: Bennett 1952; Chapman 1952; Griffin 1945, 1952; Maxwell 1952; Quimby 1952; Sears and Griffin 1950; Wilford 1954, 1955; Wray 1952.
South (early): Ford and Webb 1956; Phillips, Ford and Griffin 1951; Sears and Griffin 1950.
South (later): Ford and Quimby 1945; Jennings 1952; Phillips, Ford, and Griffin 1951; Rowe 1952; Sears and Griffin 1950.

terns of growth of eastern North America, Asian influences have been pervasive in providing content to preceramic and early ceramic cultures east of the Mississippi, particularly the Northeast.

5. The same conclusion finds support from a consideration of a large number of features pertaining to vessel manufacture, paste, surface treatment and decoration that, both in the Lena Basin and the Early Woodland of the eastern United States, actually make up the majority of recognizable variations in pottery. They are listed in Table 2.

The Asian source of these elements may, on the basis of Baikalian chronology, be bracketed in time roughly between 3000 and 1500 B.C., perhaps more specifically in the earlier half of this span, since all the features concerned but one (cord-wrapped stick impression) of those present at all in the Baikal may be dated there as early as Serovo. Cord-wrapped stick impression, if actually no earlier than Glazkovo, still need probably not set the terminus post quem here, since it is very probable that another source besides the Lena Basin should be invoked for some Amerasian traits of Early and Middle Woodland, and that cord-wrapped stick impression may be one of those traits.

The Middle and Lower Lena links in the diffusional chain may be roughly identified with the late Neolithic and Early Bronze periods, dated at about 2000 to 1500 B.C. Receipt of the traits in eastern North America appears to begin at about 1000 B.C., with some features (some Hopewellian modes of decoration and perhaps check stamping) lagging as late as the beginning of Middle Woodland (about the beginning of our era or somewhat earlier).

Of the 5 regional ceramic groupings distinguished in the Early Woodland of eastern North America in Table 2, it seems probable that the fifth, "South (later)," made to accommodate such potteries as the Watts Bar, Miller I, Alexander, Benson, Long Branch, Dunlap, Tchula, and Tchefuncte, is largely derivative from northern, or else earlier local, pottery, though the actual events of the process are still hypothetical. The reason for thinking this is that the group possesses no Amerasian features not found in one of the other groupings except check stamping. With the exception of fiber temper, linear punctation, and triangular-tooth dentate stamping, this also holds true of the probably earlier fiber-tempered pottery of the South "South (earlier)." If the partial contemporaneity of the Hopewellian and fiber-tempered pottery developments of, respectively, the Upper Mississippi and Lower Mississippi areas is granted (Ford and Webb 1956: 116), only fiber tempering remains as an early southern trait with no plausible northern antecedents. Linear punctation, while not a Hopewellian trait, is well-known on Laurel and Anderson pottery (Wilford 1955: 134; MacNeish 1956c: 33) of Minnesota and Manitoba whose contemporaneity with Hopewell is likely. As in Serovo, linear punctation was sometimes applied to Laurel pottery with a serrate stylus.

Check stamping, in the main, is probably later in the South than most of the features listed in our "South (later)" column and, by northern chronological standards, should therefore not rate as "Early Woodland." However, in the Pickwick Basin, its beginnings apparently go back as early as that of Long Branch Fabric-Marked, though its peak of popularity falls later (see Sears and Griffin 1950). Similarly, Deptford pottery, while generally later than Dunlap-Mossy Oak pottery, may have appeared contemporaneously with it in Georgia. This would still presumably make it later than many other Amerasian features to the north, and it is interesting to speculate whether its relative lateness both in the Firth River area (MacNeish 1956a) and in the Siberian Arctic, where it occurs following the predominance of other surfacing techniques, is an accidental parallelism. Be that as it may, the penetration of check stamping southward through the northern Woodland area has yet to be documented archaeologically. The fact that ordinary quadrangular, "bold," rhombic, and linear check stamping occur both in Asia and the American Southeast would seem to argue against the independent invention of this treatment in the 2 areas.

Except for fiber tempering and check stamping, the array of Amerasian traits in the 3 northern areas distinguished in Table 1 is complete. Differences between areas and, to an even greater extent, between specific cultures in those areas, appear random in the present state of our knowledge. The Northeast appears to lack linear stamping and clay temper. The Middle Atlantic area is alone in yielding early evidence of lump modeling and worked sherds, though both traits may easily have been overlooked elsewhere.

The Middle West possesses a few features not found in other areas: these include nodes punched from the inside and cord impression on the Early Woodland level, and linear punctation, crosshatch incision, crescent dentate stamping, and "maggot" dentate stamping in Middle Woodland.

It is of interest to note that pottery, while presumably diffused from eastern Asia at approximately the same time as the nonceramic traits examined earlier, was later in reaching eastern North America. Of the nonceramic traits in Table 1, only a few are comparatively late in arriving east of the Mississippi. This differential rate of diffusion is of some theoretical interest, if we consider that some Woodland pottery traits that appear to have reached Nuclear America on an early time level (for example, rocker stamping, dentate stamping, probably fabric marking, and perhaps cord marking) can hardly be dated there very much later than in the eastern United States. This would seem to imply by contrast, that the Arctic was a major obstacle to the transmission of pottery from the Old World to the New. Similarly, the scarcity of pottery at the Early Uolba sites of the Lower Lena, its relatively limited use by inland Alaskan tribes (Oswalt 1955: 38), its absence on the Northwest coast from contexts where it might be expected to occur (Drucker 1955: 77), its generally poor quality in the Arctic when made, all suggest factors, environmental, cultural or both, inhibiting the extensive use or development of pottery in the Northwest and Arctic. In this connection, the rather patchy list of "relicts" we have to offer in Table 2 is eloquent.

It is our belief that evidence for the transmission of pottery at an early date eastward from Bering Strait will be harder to find than comparable evidence for other traits. Whatever the reason, evidence, or more exactly lack of it, suggests that the progress of pottery through the Arctic was a slow process, and that it may perhaps have taken place on such a trivial scale that we will never be able to pick up many of the threads leading to the Woodland cultures of the Middle West and East. With the notable exception of some early Virginia pottery, as pointed out in our discussion of the Serovo culture, the actual trait combinations represented in Early Woodland pottery have no striking parallels in eastern Asia. This also supports the view of a drawn-out transmission process, made up of minor local diffusions, in which new combinations and recombinations of ideas would constantly occur and be greatly affected by chance. Both the apparent randomness of the process, and the difficulty of documenting it archaeologically might thus result from the small size and relative poverty (at least in pottery) of the mediating groups. A note of optimism, however, seems justified in the light of MacNeish's (1956a) recent work in the Firth River area. Also not to be dismissed is the evidence that Anderson pottery (MacNeish 1956c) extends as far north as the Churchill River in northern Manitoba (MacNeish, personal communication). This pottery, which is coiled, granular tempered, net impressed, and cord marked, has pointed bottoms and is decorated with rows of punctations below the lip, dentate stamp impressions, cord-wrapped stick impressions, and linear punctation. In this connection, it is well to keep in mind that early northern pottery of Asian derivation, when found, may well have a Middle Woodland, rather than Early Woodland cast to it, since Middle Woodland pottery in eastern North America has a more complete range of Amerasian features than earlier wares. The latter, in such case, could then be seen as early and simplified renditions of more complex prototypes already in existence elsewhere.

There seems to be little reason to doubt that the ultimate origin of many Woodland ceramic traits lies in the Baikal area. Whether their diffusion from the Baikal was necessarily down the Lena is another matter. As Spaulding (1946: 146) has pointed out, the "limited carrying capacity" of the taiga is a strong stimulus to population movements. Such movements need not be confined to major water courses, and Okladnikov finds evidence, in particular, of contacts between the Middle Lena and the Amur valley in prehistoric times (1955b: 129). Published information on the archaeology of the Amur and Pacific coast areas of eastern Asia is very scant. Yet we know that the situla and flowerpot shapes, net impression, dentate stamping, red filming, and a well-developed ground stone industry are among the traits represented there in the earliest Neolithic, which is said to resemble the Jomon cultures of Japan (Okladnikov 1936). These are better known to western students through Groot's (1951) synthesis. In addition to many traits also found in the Baikal (including cord-wrapped stick impression), the Japanese Neolithic possesses such ceramic traits

as the flowerpot and situla shapes, hollow reed punctation, zoning, rocker stamping, tube-shaped vessels (a form also represented in the Laurel culture of Minnesota [Bennett 1952: 112]), interior red filming, and clay figurines, and, in stonework, pitted stones, grooved mauls, and tenoned hoes. The fusion of some such complex with one emanating from the Baikal or Middle Lena seems likely if we are to account fully for Asian parallels in American Early and Middle Woodland cultures, particularly in the Middle West. It may have taken place incidentally as Siberian culture flow was funneled through Bering Strait. On the other hand, it may already be represented in "pre-mixed" form in the little known cultures of the Okhotsk mainland.

6. A final group of American culture elements whose origins seem to lie in Asia is confined to the northwestern portion of the continent. Table 3 lists those occurring in the Lena Basin. MacNeish's find of a chipped semilunar knife in the Tlaltheilei complex (1951: 40) should be given special mention. If this complex is actually paleo-Indian in date, which it may well be since it precedes the Artillery Lake complex in the Great Slave-Athabasca region, this trait may have to be included with those under our third heading, traits of apparent American origin . (See also Note 22, Table 1.)

It seems significant that most of the elements in Table 3 are of Kitoi or Early Bronze date in the Lena Basin, and thus got off to a relatively late start. As in the case of traits in Tables 1

TABLE 3. SOME CONTRIBUTIONS OF THE CULTURES OF NORTHEAST ASIA TO THOSE OF THE AMERICAN ARCTIC AND NORTHWEST.

As in Table 1, complete American distributions are not attempted; entries are suggestive of temporal and geographic range. In connection with the chipped ulu, see Note 22 of Table 1.

TRAIT	BAIKAL	MIDDLE LENA	LOWER LENA-ARCTIC	AMERICAN ARCTIC AND NORTHWEST
Tubular needle-case	Isakovo	Kullaty	Early Bronze	Kachemak I[1]
Antler mattock	Isakovo			Okvik[2]
Birchbark rolls		Kullaty	Uolba II	British Columbia[3]
Bird point	Serovo		Early Bronze	Okvik[4]
Reinforced bow with bone backing	Serovo			Eskimo[5]
Pièces ecaillées		Kullaty		Sarqaq[6]
Chipped ulu	Kitoi		Uolba II	Ipiutak[7]
Tree barker	Kitoi	Early Bronze	Early Bronze	Eskimo[8]
Circle-and-dot motif	Kitoi			Plateau[9]
Slat armor	Glazkovo			Northwest Coast[10]
Wooden grave marker	Glazkovo			Plateau[11]
Inlaid eyeballs as grave accompaniment	Glazkovo			Ipiutak[12]
Burial parallel to river, head downstream	Glazkovo			Plateau[13]
Split-base, split-tip bone arrowheads		Early Bronze	Early Bronze	Near-Ipiutak[14]
Antler adz socket			Late Bronze	Kachemak I[15]
Iron	approx. 300 B.C.			Okvik[16]

[1] De Laguna 1934, Pl. 44, *26-7*.
[2] Rainey 1941, Fig. 22.
[3] Borden 1952: 33.
[4] Rainey 1941, Fig. 14, *14-16*.
[5] Okladnikov 1950a: 226.
[6] Meldgaard 1952, Fig. 76, *15*
[7] Larsen and Rainey 1948, Pl. 2, *30-3*.
[8] Nelson 1899, Pl. 38.
[9] Collier and others 1942: 112.
[10] Drucker 1955: 79.
[11] Collier and others 1942: 42.
[12] Larsen and Rainey 1948, Pl. 98, *1-2*.
[13] Collier and others 1942: 42.
[14] Larsen and Rainey 1948, Pl. 78, *12-14*.
[15] De Laguna 1934, Pl. 19, *1*, 5-6.
[16] Larsen and Rainey 1948: 83.

and 2, the possibility should be kept in mind that their source may not always lie in the Baikal, but in other areas of Northeast Asia to which the Baikal is peripheral, such as the Amur basin and the Pacific coast.

Traits not Considered Above. Deliberately omitted from our discussion are a number of ubiquitous culture elements of which the distribution is widespread and the form simple. They include awls, bodkins, needles, whetstones, beads, and many other artifacts on which distributional information would, at this juncture, be relatively unrewarding. Many of them are common enough that their absence, in many cases, could hardly be ascribed to anything but sampling error or poor preservation, while their presence would have little significance.

In a somewhat different class are such chipped stone artifacts as choppers, drills, gravers, scrapers, and some knife forms, whose typology, at present, is not advanced enough to allow convincing comparisons, but whose variations of form would seem more obviously susceptible to useful classification. As already stated, it is in this class that very early parallels between Asia and America probably should be sought.

Finally, there are culture elements which give no evidence of having diffused between both continents, and foremost among these are burial mounds, often referred to in comparisons between Asia and eastern North America, and copper metallurgy, whose independent development in the Great Lakes area has been strongly implied by recent radiocarbon dates.

DIFFUSION: THEORETICAL CONSIDERATIONS

A diffusional hypothesis, ideally, should be supported by a theory of diffusion. No suitable theory, however, is at hand, and we are hardly prepared to remedy this deficiency here. We propose, nevertheless, to contribute to it the following remarks.

In judging the merits of a diffusional case, 2 tests have enjoyed some currency in the past. One of them is formal comparison of assemblages the connection of which is to be demonstrated, to arrive at an estimate of the complexity or uniqueness of their resemblance. This test has suffered from notorious abuses and, as part of the Kulturkreis arsenal, is often viewed with suspicion. The other test is the traditional choice of the empirical dirt archaeologist, who requires "a complex of traits such as listed above at a series of dated sites from Lake Baikal across northeastern Siberia and across Alaska" (MacNeish 1954: 252) and, for our purposes, across most of Canada to the eastern seaboard, at least as far as the traits listed under 4 and 5 of the preceding section are concerned. This particular usage of the term "complex" denotes, presumably, a number of traits traveling together that get to their final destination as a group.

We would like to register here the opinion that the expectation of meeting the requirements of the second test is often an unrealistic one and, in some situations, simply unwarranted. We submit, furthermore, that there is now enough material to allow us to claim an approximate solution by the first test (which is essentially our procedure here) of some of the diffusional problems examined in this paper. An "exact" solution, on the other hand, is probably by no means around the corner, and if we wait for the availability of data qualifying for the second test we may well postpone any solution at all beyond the point of diminishing archaeological returns for some of the geographical intermediate areas. If, for example, the archaeological resources of the Canadian taiga even equal those of the Plateau area of North America, the prospect can be said to be a clouded one. In any event, the number of specific trait transmission traceable as a complex at a "series of dated sites" will always remain limited as compared to the number which may be inferred by applying the first test to materials from such rewarding areas as the Baikal or Northeastern North America. There seem to be good reasons why this should be so.

"Culture-jumping" is by now a familiar enough phenomenon to the archaeologist to have received baptism in print (for example, Jennings 1956: 119). While its concrete explanation in any given instance probably varies, its recognition is fundamentally that of the limitations of archaeological sampling. Optimism concerning the potentialities of archaeological fieldwork has sometimes resulted in the tacit assumption that, if any nonperishable culture element was ever represented in the past in a given area, it would sooner or later be discovered by dint of unceasing spadework. Conversely, the judgment has often prevailed that it was somehow slipshod or unscientific or, at best, archaeological license, to postulate the presence of a trait at a given time or place without artifacts

to prove it. This view neglects to take into account the fact that fieldwork samples a relatively small portion of the prehistoric population for any given time or place, and that the rarest items in large and apparently "adequate" collections were probably by no means as rare to their users or makers as they appear to us. The reasonable expectancy of finding a truly rare item, such as the basket-handle bowl may have been to the prehistoric inhabitants of Texas or northern Tamaulipas, or maggot-impressed pottery to the wandering inhabitants of the Alaskan interior, may thus be practically nil. Generally, the more concrete, minute, and trivial daily acts of individuals singly or in groups that Giddings (1952) so plausibly describes as the normal diffusional process in the Bering Strait region are probably largely out of reach of the archaeologist. Yet, in areas of archaeological "lows," such as the Plateau or, very probably, parts of interior Canada, the fate of many of the items under discussion has probably depended, over considerable distances, precisely and largely on such very casual acts. In densely populated and permanently settled areas, such acts are repeated often enough and are compounded into large enough patterns to be detectable through artifacts. In the Southeast, for example, the transmission of cord-marked pottery for a 300-mile distance stands at least a good chance of involving the pottery-making habits of many villages, and of being recorded in their refuse material. In northern Canada or Siberia, no more than a few migratory bands may be involved, and their use of pottery may be slight to begin with, a circumstance which may slow up but would in no way prevent their acting as conducting media for that trait. What campsites of theirs we happen upon, if any, may not include the one where one of the few pots in use was broken, or may have been occupied by individuals who didn't happen to bring any pots along, or, finally, a few sherds may actually occur at the site but they may escape detection. The limitations of sampling error are severe enough in areas of dense population and good archaeological coverage. In areas of sparse population, where historical events were on a predominantly trivial scale, where archaeological remains are scant, and where the items sought for may never have been a significant part of the culture, they are formidable. Therefore, it seems well worth pondering the waiver of the rigid requirements of the second test when diffusional investigation would be severely handicapped by insisting upon them.

"Complexes," such as might be blithely postulated from the various sets of comparative data presented here, have, like some easily assumed "continuous" distributions, a way of dissolving on closer inspection; this is well illustrated in a recent study of Mesoamerican-Southeastern relationships (Phillips, Ford, and Griffin 1951). Not only has a series of dated sites failed to materialize between Mexico and the Southeast since Vaillant first postulated the "Q-complex," but knowledge far superior to that we now have of the American Northwest and Siberian interior has shown that, of the items suspected to have diffused, "each has its own separate history and each its contribution to the manifold problem of the origin of Mississippi culture." On broad uniformitarian grounds, it seems justified to postulate a similar historical reality behind our Amerasian trait lists, until concrete evidence is adduced to the contrary. A "complex" is a useful concept to describe the fact that a number of traits appear to have roughly parallel histories in terms of such gross time-space units as "the Lena Basin, 500 to 1500 B.C.," "the American Northwest, 4000 B.C. to the present," or "the American Northeast, 4000 to 1 B.C." However, it is a function of the scale of analysis used and a product of a certain perspective or removal from the plane of concrete data. When we get down to details and have more accurate control of intervening areas, our impression of dealing with "complexes" will probably be weakened, not reinforced. The writer is, in fact, willing to predict that, as our knowledge improves, there will appear in interior Canada, Alaska, and northern Siberia not a single "series of dated sites" but a fine dust of variously dated sites, with varying and, for our purposes, incomplete inventories; that the ways of diffusion will be found to be tortuous or multiple geographically and at times devious typologically; and that we will not, any more than in the better known areas of the Old and New Worlds, and perhaps less so, be able to relinquish the working view of diffusion as a somewhat random process of "broadcasting" over wide areas and time intervals whose precise operation but rarely appears in sharp focus. *Ferninterpretation* will have to be resorted to in many cases if a coherent reconstruction of past events is to emerge.

We have avoided so far any discussion of the typological problems posed by the comparative

approach. They are many and fundamental. At the same time, their resolution has been notoriously uncodified and dependent on personal judgment. No thoroughgoing discussion of the problem will be attempted here. As in the question of what constitutes adequate sampling, however, there is one common fallacy which requires comment and which might be termed the "fallacy of the fixed standard." It is the assumption that it is possible to discover a fixed set of criteria whereby a resemblance may be judged to be significant or not. In the analogous case of sampling or coverage, the impossibility of arriving at a standard of what is adequate is obvious. For a problem of considerable magnitude, such as whether Mesoamerican and Peruvian rocker stamping are connected, relatively light coverage (say, the occurrence of the technique in an Archaic context in all or most of the intervening Latin American republics) may yield highly suggestive data. Data of comparable scatter and rough dating are clearly inadequate, on the other hand, to determine the when and where of the connection between rocker stamping in the Valley of Mexico and in Tabasco. Similarly in problems of typology, the requirement of precision varies with the magnitude of the problem attacked. Thus, the occurrence of barbed, nontoggling, "male" harpoons at 2 different sites in New York state is valueless as a criterion of specific relationship, unless the harpoons in question share other, more minute features. However, against the broad background of North American prehistory, the same typological concept of the barbed harpoon may be valid in the light of the absence or scarcity of such harpoons in areas other than the Northeast, Northwest, and Alaska. Yet, a frequent and utterly specious critique of comparative evidence is often predicated on differences found to exist between the items compared, on the assumption that there are constant criteria of form and function for what constitutes true resemblance or difference, independent of distributional evidence.

We do not claim that all the parallels offered in the preceding pages will survive the most enlightened criticism, and there is a possibility that our thesis of the diffusion of certain features from North America to Asia may collapse altogether in the light of new evidence. However, the fact may as well be faced that there exists as yet no conclusive method of evaluating them that would transcend the criteria of intuitive and personal judgment. Common sense, rather than methodological rigor, has led to some of the omissions in our comparisons. Perhaps some of the simpler ceramic traits in Table 2 could be eliminated on the same grounds. Yet, 2 final points in this connection must be made. The first is that such relatively simple parallels as granular temper, round bases, or crack lacing, when occurring alongside more striking ones, serve to emphasize the overlap in total range of variation between the potteries examined. They thus serve to protect the diffusional thesis from objections that could be raised if these parallels were absent, if, for example, northeast Asian pottery were overwhelmingly asbestos tempered or never made use of crack lacing. The second point is one aptly made by Leroi-Gourhan (1946) that "repeated convergences may be evidence of basic unity." The reasoning here is, essentially, that in the process of random culture change, a third step in a sequence of changes may well be a reversion to the form from which the second step deviated. No more than in the case of transmissions assumed to have taken place within the broad time-space units of Table 1, can we elaborate this general statement with specific illustrations, except in highly speculative terms. Thus, it is entirely possible that stone gouges, apparently absent from northwestern North America, may have made their way eastward as bone tools (bone gouges do occur on the Northwest coast and elsewhere) and that the stone gouges of Frontenac are, in a sense, products of convergence back toward Asian prototypes. What matters is not the truth or even the plausibility of this example. The important thing is to allow for this mechanism of culture change in marshalling comparative evidence, which is not vitiated thereby. Convergence, like distributional continuity, adhesion in complexes, and typological similarity, is thus in a sense an elusive concept and a function of the plane of abstraction or closeness with which culture-historical events are examined.

SUMMARY

In the first part of this paper, we attempted to summarize some of the information now available on the archaeology of the Lena Basin and Siberian Arctic, with particular emphasis on the Neolithic period and on culture elements that have parallels on the North American continent.

In the second portion, we have advanced evidence for intercontinental diffusion, particularly as suggested by 4 series of comparisons:

1. Between Cape Denbigh and related sites in North America and some apparently later phenomena of the Siberian Arctic, Middle Lena, and Baikal areas. While finding support for prevailing views concerning the introduction of the core-and-blade complex into the New World from Asia, we have been led to infer a roughly coeval dissemination of certain lithic types from America to Asia, and to seek their ultimate origin in the American Plains at a much earlier date than their first recorded appearance in Siberia.

2. Between the nonceramic inventory of Neolithic and Early Bronze cultures of the Baikal, and traits of the Archaic and earlier Woodland cultures of eastern North America. With some earlier and later exceptions, most of these traits are present by late Neolithic times in the Baikal and occur in the Late Archaic cultures of northeastern North America.

3. Between the ceramic inventories of the Baikal, Middle Lena, and Lower Lena cultures of the same period, and Early and Middle Woodland pottery in the eastern United States. These comparisons led us to conclude that pottery diffused much more slowly than did most of the nonceramic traits of the preceding group. Unlike most of the latter, many cannot be shown to have ever been present in intervening areas. Both this paucity of evidence and the relative lag in its penetration to eastern Canada and the United States leads us to speculate that the American Arctic and Subarctic may have been, in some manner, a deterrent to the spread of pottery between the 2 continents.

4. Between some nonceramic features of the Lena sequence, many of them Bronze Age or late Neolithic in date, and the cultures of northwestern North America, particularly the Eskimo.

Many of the implications of these conclusions remain to be explored. Thus, there exists abundant evidence of prehistoric contacts westward across northern Siberia (Okladnikov 1955b: 131-3; 1957; Gimbutas 1956, Fig. 106) and of their effect on Neolithic cultures of the northern Russian and Scandinavian areas. The high development of flint chipping techniques around 2000 B.C. in these European regions, and the specific similarities of the so-called White Sea points to both American Arctic and "Yuma" forms should be examined in this light. In connection with the Asian derivation of some stone tool forms of the North American Archaic, other foci of stone grinding in the New World should be examined to determine the role of stimulation from North America and, ultimately, the Old World. More particularly, South American assemblages should be investigated with this in mind (see Willey 1955: 32), especially since ceramic traits of a Woodland nature, in addition to being known in intervening areas of Nuclear America and the Circumcaribbean, are found in the Argentinian pampa. Finally, in connection with North American developments, the publication of Russian work in the Amur area and the Okhotsk seaboard is to be awaited eagerly. There are indications that these areas may have contributed a significant share of Amerasian traits to Early and Middle Woodland, and perhaps Archaic culture of eastern North America.

In conclusion, it may be stated that the evidence of the last decade of work in Asia and North America alike provides firm support for Spaulding's view (1946: 148) that the northern boreal forest zone has been the medium of long-continued contacts between the 2 continents.

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New York, N.Y.
May, 1957

VERE GORDON CHILDE

1892-1957

He was ". . . the leading prehistoric archaeologist of our time. . . . Were it not for the range and depth of his interests and his extraordinary capacity to establish the time-space relationships of such a vast and complex array of data, the foundations of our knowledge of Old World archaeology would never have been written." In addition, he "has made a series of provocative but nonetheless brilliant contributions [to] the theory and method of archaeology."

The foregoing words, taken from Hallam L. Movius' review of *Contributions to Prehistoric Archaeology Offered to Professor V. Gordon Childe in Honor of his Sixty-Fifth Birthday by Twenty-Seven Authors* (*Man*, Vol. 57, Art. 42, pp. 42-3, 1957), accurately sum up Childe's position in our profession and his principal contributions to it. Anthropologists the world over will feel his loss, at the height of his powers, as the result of a fall from a cliff in the Blue Mountains near Sydney, Australia, on October 19, 1957. He had just retired from the faculty of the University of London and had returned to his native Sydney for a 6-months' vacation, during which he had planned to write another book.

Childe was born in North Sydney on April 14, 1892. He studied Classics at the University of Sydney and in 1914 obtained a graduate fellowship to continue his classical education at Oxford University in England. While there, he did research on Indo-European elements in the Bronze Age of Greece and from this developed an interest in the prehistory of the Balkans and Central Europe.

After the First World War he returned home and became active in the Australian Labor Movement, serving from 1919-21 as private secretary to the Labor Prime Minister of New South Wales. Out of this experience came his first book, *How Labour Governs* (London, 1923).

These early activities foreshadowed a sharp and conflicting dichotomy in Childe's interests and academic approach, which was to persist throughout most of his career. On the one hand, he was a humanist, deeply immersed in the data of archaeology and better able than any other scholar of his generation to synthesize those data from a historical point of view. On the other hand, he was a socialist, strongly influenced by Marxian theories of evolution, and this led him to produce a series of theoretical books in which he interpreted archaeological data from the standpoint of Dialectical Materialism.

His historical interests were the first to bear fruit. After his Labor interlude he traveled widely in Greece, the Balkans, and Central Europe, examining the archaeology of those areas and studying the literature, most of which he was able to read in the original languages. Out of this came *The Dawn of European Civilization*, in which he synthesized the archaeology of Europe, showing how the elements of Near Eastern and Mediterranean civilization had diffused northwards to the rest of the continent. Originally published in 1925, this book has undergone 5 revisions, the last issued in 1957.

In 1925, the year in which *The Dawn* first appeared, Childe became Librarian to the Royal Anthropological Institute and, in 1927, Abercromby Professor of Prehistoric Archaeology at the University of Edinburgh. He held the latter position until 1946, when he moved to the University of London as University Professor of Prehistoric Archaeology and Director of the Institute of Archaeology, the posts from

which he had just retired at the time of his death. In the 1930's he received honorary degrees from Harvard University and the University of Pennsylvania, served as Visiting Professor at the University of California, and in 1945, when he was becoming persona non grata to our State Department because of his Marxian theories, he represented Britain at the 220th anniversary celebration of the Soviet Academy of Sciences in Moscow and Leningrad.

The Dawn was followed by a series of other books in which Childe displayed his talents as a humanist and a prehistorian. Foremost among these is his *New Light on the Most Ancient East*, in which he synthesized the archaeology of the vast area from Egypt to Pakistan, showing the development of the elements of civilization there before their diffusion across the Mediterranean into Europe. Like *The Dawn*, this book is a classic in its field. Originally published in 1928 as *The Most Ancient East*, it was revised and reissued with its present title in 1934 and again in 1952. Other works of synthesis include *The Danube in Prehistory* (1929), *The Prehistory of Scotland* (1935), and *Prehistoric Communities of the British Isles* (1947). In *The Aryans* (1926) Childe made an archaeological study of the origin and spread of the Indo-Europeans and returned to this theme in his *Prehistoric Migrations in Europe* (1950). He was never very much of a field man and his only major site report is *Skara Brae: a Pictish Village in Orkney* (1931).

The socialistic and evolutionary side of Childe's interests first came to the fore in 1935, when he published *Man Makes Himself*, a work famed for its concepts of the Neolithic and Urban Revolutions, the former marked by a shift from food gathering to food production and the latter by the development of metallurgy, writing, and the other attributes of civilization. These revolutions are presented as universal events in the evolution of culture, although they are illustrated with examples taken almost entirely from the archaeology of the areas in which Childe had done his synthesizing, especially the Near East. In *What Happened in History* (1942) he combined his system of revolutions with Lewis H. Morgan's stages of Savagery, Barbarism, and Civilization and illustrated them more fully with examples from the archaeological literature; and in *Progress and Archaeology* (1944) he discussed evolution from a topical standpoint, that is, in terms of the food quest, burials, tools, etc., rather than in terms of stages. In *History* (1947) he traced the development of historical method from prehistoric time to Marx's Dialectical Materialism, ending with an indirect tribute to Stalin as an exponent of the latter. He concluded his *Society and Knowledge* (1956) with the prediction that the "Humanist ideal" will eventually become subordinate to the ideal of "Society."

Whereas Childe's works of historical synthesis were primarily inductive, that is, he drew his conclusions out of the data, his evolutionary writings tended instead to be deductive, in that he assumed the theories and selected facts from the archaeology to illustrate them. In so doing, he ignored other facts which were contrary to the theories. He was too good a prehistorian not to recognize the existence of these conflicting facts and in 1951 published a new study, *Social Evolution*, in which in effect he repudiated the universal type of evolution to which his socialistic tendencies had previously led him. Examining in detail the chronological sequences in a series of areas extending from Europe to the Near East and the Nile Valley, he came to the conclusion that the evolutionary process had varied from area to area, depending on local environmental and economic conditions and upon the operation of the process of diffusion. He restated this conclusion as follows in "The Evolution of Society," published posthumously in *Antiquity* (No. 124, Dec. 1957, pp. 210-13):

> With the general acceptance of the doctrine of organic evolution continuity between human history and natural history was also accepted. The latter [*sic*] became just the latest chapters in a single historical record with archaeology bridging the gap between the record of the rocks and the written record. The content of these latest chapters may be termed social evolution, and the Darwinian mechanisms of variation, adaptation, selection and survival may be invoked to elucidate the history of man as well as that of other organisms. But while the use of these terms may emphasize the continuity of history, it may also cause confusions and, in fact, misled some of the early anthropologists and archaeologists when they tried uncritically to apply Darwinian formulae to human societies or artifacts. . . .
>
> In fact, the intrusion of diffusion as an agent of evolution . . . has so drastically altered the historical process that no analogy between the evolution of species and the evolution of societies is valid. . . .
>
> The doctrine of evolution has raised human history above the domain of miraculous revelation or romantic fiction. . . . It has not provided a new extraneous agency

to replace discredited deities or facts, nor revealed a short cut to conclusions that should obviate the collection of facts.

One wonders whether Childe's career, culminating in these words, may not contain a lesson for New World archaeologists. There is a curious, if somewhat superficial, parallel between Childe's repudiated universal approach to evolution and the developmental classifications which are now the vogue in American archaeology. Will the latter, with their sequences of stages which are supposed to be universal throughout the western hemisphere, eventually prove to be more successful than Childe's stages, which he found to be limited in their applicability to the Near East; or will the New World stages, too, have to be regarded as an erroneous "short cut to conclusions" and an unsound way to "obviate the collection of facts," restricted in applicability primarily to the centers of Amerindian civilization?

Childe's specific historical conclusions, limited as they are to Europe and the Near East, and to the protohistoric period, need not concern us here. His methods of historical synthesis are pertinent, however; for how often has it been said that the New World needs a Childe to synthesize the results of our researches! Although he summarized his methodology in *Piecing Together the Past* (1956), this hardly does him justice, probably because he tended to work intuitively. Indeed, his syntheses are characterized by a paucity of conceptual tools, the principal one being the concept of a culture, corresponding to that of a focus or a phase in this country. To determine the dates of cultures, he relied primarily upon "synchronisms" with historic archaeology, that is, he looked for artifact types common both to his prehistoric cultures and to the contemporaneous civilizations and assigned the dates for the types in the latter to the former. "Integrative" concepts such as horizons or traditions had no place in his syntheses. He tended to stress the survival of earlier forms of culture in peripheries rather than the principle that similarities necessarily indicate contemporaneity, and was sensitive to the possibility that 2 cultures might have coexisted in the same area. It was he who first suggested that the Forest cultures were distinct from Mesolithic cultures in other types of environment, a distinction subsequently elaborated by Grahame Clark in *The Mesolithic Settlement of Northern Europe* (1936).

Childe's works of synthesis are often difficult to read because of his attention to detail, not only in material culture but also in the nonmaterial implications of the remains, to which his Marxist orientation led him to pay more attention than most archaeologists of his generation. His syntheses are well organized in narrative form, however, and the whole is never submerged in the details. In last analysis it was his encyclopedic knowledge of the facts of archaeology and his ability to digest them which made him such a superb synthesizer.

IRVING ROUSE

NOTE: A bibliography of the publications of V. Gordon Childe, compiled by Isobel F. Smith, was published in the *Proceedings of the Prehistoric Society for 1955*, n.s. Vol. 21, pp. 295-304 (Cambridge, 1956).

Two posthumous publications by Childe have appeared since the above went to press: *The Prehistory of European Society* (Pelican Books, 1958) and "Retrospect" (*Antiquity*, 1958, Vol. 32, No. 126, pp. 69-74). The former is essentially a popularization of *The Dawn of European Civilization*. In "Retrospect," Childe surveys his life's work and in effect writes his own obituary. The reader may find it interesting to compare the latter with the evaluation presented here. (In it, Childe comments as follows on an aberrant use of the concept of horizon: "This was childish, not Childeish.")

EDITOR'S NOTE: The Facts and Comments section is omitted in this issue because of lack of space, but will appear again in future issues.

REVIEWS

Edited by Donald Collier

Mushrooms, Russia and History. 2 vols. Valentina Pavlovna Wasson and R. Gordon Wasson. Pantheon Books, New York, 1957. xxi + xxii + 433 pp., 28 figs., 82 + 3 pls. $125.00.

This remarkable 2-volume work represents the first report in book form of 30 years of research on mushrooms by Mr. and Mrs. Wasson. The work is interestingly written and magnificently illustrated in this edition of only 512 numbered copies. (As soon as I finish this review, Copy No. 179 will be passed along to the Peabody Museum Library, where I trust it will be much used.)

The book covers an encyclopedic range of information about mushrooms and their relationships to human history, languages, and cultures in various parts of the world. The analysis of words for mushrooms and their symbolic associations in many cultures will interest the linguists and philologists; the descriptions and illustrations of mushrooms will certainly delight the mycologists; the contrast drawn between mycophiles (for example, the Russians) and mycophobes (for example, the English) will provide students of national character with a new dimension I'm certain they haven't considered before; archaeologists and ethnologists will be interested in the findings concerning "sacred mushrooms" of Middle America; and for the casual reader who likes to gather and eat mushrooms there are even descriptions and colored plates of various species of edible mushrooms and of the lethal *amanita*. Insofar as I can judge this encyclopedic range of knowledge, the factual information is presented with scholarly care and precision.

But like the writers of all interesting books, the Wassons do more than present facts about mushrooms, gathered over the past 30 years. They make interpretations, and they present a number of far-reaching hypotheses on the role of mushrooms in cultural development. They are careful to indicate that these are speculative hypotheses and that they are of varying degrees of plausibility.

Since it would be patently impossible to do justice to the full range of fact and interpretation within the limits of one review, I shall summarize and comment briefly upon 2 of these central hypotheses, and then turn to the "sacred mushrooms" of Middle America, a subject which will command the widest attention among American anthropologists.

The first hypothesis presented by the Wassons had its roots in an experience in 1927 which is best described in Mrs. Wasson's words:

> The Catskill Mountains in August are filled with mushrooms, exquisitely beautiful. (We Russians are always finding mushrooms wherever we go, even where our American friends tell us there are none.) In 1927 I had just married my American husband, and we were spending our first holiday in the lodge of Adam Dingwall, a friend, near Big Indian. With what astonishment my husband saw me, on our first walk, dart with ecstasy to this fungus and that, and on bended knee strike what seemed to him poses of adoration! With what horror he strove unsuccessfully, to keep me from bringing home and eating a mess of fragrant *lisichki*! (Pp. 4-5.)

The Wassons went on to explore this fundamental difference in attitude toward mushrooms, and have over the years collected data to try to support the hypothesis that Russians (and other Slavic peoples) are mycophiles, while Anglo-Saxons are mycophobes who associate "evil" toads with mushrooms and call many of them "toadstools." In the course of the 2 volumes, other cultures are fitted into this dichotomy; for example, the Japanese and Arabs are mycophiles, while the Greeks and the Portuguese are mycophobes. By the time the Wassons finish with this theme, it is erected into a theory of national character practically on a par with Ruth Benedict's Appollonian-Dionysian characterization! How plausible is the idea? That there are systematic differences in the ethnomycology of different cultural groups is not surprising, any more than it is to discover that cultures vary in their other ethnobotanical aspects, or for that matter in any other point of a vast range of relationships to the natural environment. But the significance of these differences in their cultural histories and their patterns of culture is quite another matter, especially since in no culture have mushrooms yet become more than a minor supplementary food supply. The Wassons' information and arguments are stimulating, but they remind me of efforts to differentiate between Spanish and Anglo-American cultures on the basis of whether the people are *aficionados*, or are strongly opposed to bull-fighting. Both types of interpretations contain insights into cultural differences, but their importance can be easily overdrawn.

The Wassons go on, however, to propose an even bolder hypothesis. They observe that hallucinatory mushrooms are consumed in Northern Siberia, in the Mount Hagen area of New Guinea, and in Middle America, and they advance the notion that this widely scattered distribution may derive from a point of origin somewhere in Eurasia in the remote Paleolithic, when men first discovered the hallucinatory powers of certain mushrooms. Further,

> Our mushrooms must have unlimbered the imagination of those first men that ate them, stirred their curiosity and speculative faculties. Our mushrooms could have sparked in them the very idea of God. . . . We may be tapping the very well-spring of the religious idea (p. 319).

That the visions and hallucinations of individuals through the centuries in various cultures have become incorporated into religious systems is a fairly well-accepted proposition. But that the core of religion stems basically from hallucinations induced by certain species of mushrooms, rather than, for example, from dreams (without mushrooms), from peyote, from dozens of other types of narcotics and liquors consumed around the world, from lonely vision quests, or from various types of stimulating and/or frustrating social experiences, strikes me as a

most implausible hypothesis, despite the Wassons' attempt to link up mushrooms with lightning and thunder in certain religious symbol systems.

In their discussion of the use of hallucinogenic mushrooms in Middle America, the Wassons are on sounder ground; indeed, they have, in my judgment, made a genuine contribution to the ethnology of Middle America. Here they have made careful and systematic use of archaeological and ethnohistorical data, they have personally done field work on the subject in Oaxaca, and they have worked closely with Middle Americanists, such as Robert J. Weitlaner and Stephan F. de Borhegyi.

As the Wassons themselves point out, they were not the first to discover the use of divinatory mushrooms in Mexico. They were mentioned by Sahagún and other early chroniclers; they were rediscovered by Weitlaner in Oaxaca in 1936. But to the Wassons belongs the distinction of pursuing the subject assiduously, of bringing scattered data to bear on the subject, and of being the first outside investigators to personally consume the mushrooms and experience successful hallucinations. The account is an absorbing one that should be read by all anthropologists interested in Middle America.

As their findings now stand, it appears that hallucinogenic mushrooms were definitely used by the Nahua and Otomí peoples of Central Mexico, by the Mazatecs, Mixtecs, Zapotecs, and Mixe of Oaxaca, and perhaps also by the Tarascans and a few other tribes. (Robert Ravicz has additional confirming evidence, collected in the field during 1955-56, of their use among the contemporary Mixtecs.) There is no other evidence of their use in Western and Northern Mexico, which interestingly enough is the area of heavy peyote consumption, suggesting that perhaps peyote provided a functional equivalent in this region. To the East in Chiapas and Guatemala, the evidence to date is also negative, except for the curious so-called "mushroom stones" which appear in Preclassic and Classic Maya sites in the central highlands and Pacific coastal plains of Guatemala. These "mushroom stones" have been studied by Borhegyi, who has provided the chart of their geographical and chronological distribution published in the end-pocket of the Wasson book. The Wassons make much of these "mushroom stones" on the theory that there existed a divinatory mushroom cult among the Highland Maya which disappeared after the Spanish conquest destroyed the priesthood structure of the ancient Maya. These artifacts certainly do resemble mushrooms, and the Wasson theory as to their use and significance is presently as plausible as anything anyone else has been able to advance. However, further ethnohistorical data or contemporary ethnological data establishing a link between these artifacts and the use of mushrooms in the Maya area are needed, as the Wassons themselves suggest, before this interpretation can be accepted.

A more recent publication (Roger Heim 1957, "Les Agarics hallucinogènes du genre *Psilocybe* recueillis au cours de notre récente mission dans le Mexique méridional et central. . . ." *Institut de France, Academie des Sciences*, Vol. 244, pp. 695-700) provides the latest information on the mycological identification of the species of divinatory mushrooms collected in Mexico by the Wasson expeditions.

That at least some of these mushrooms can produce hallucinatory effects is documented from the personal experiences of the Wassons and their party who consumed the mushrooms during a ceremony in Huautla de Jiménez in 1955, and the colorful description of their hallucinations makes as entertaining reading as Aldous Huxley's *The Doors of Perception*. The Wassons have certainly succeeded in alerting the anthropological community to the possible importance of mushrooms, and a probable "mushroom cult" can be added to the "peyote cult" in the roster of American Indian religious experiences.

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The Ancient Civilizations of Peru. J. Alden Mason. Penguin Books, Baltimore, 1957. xx + 330 pp., 6 figs., 64 pls., 2 maps, 1 table. $1.25.

Mason's book is an admirable bringing together of the existing primary and secondary sources on Peruvian archaeology and Inca ethnohistory. It is organized into 4 parts: (1) a short introductory section on the natural setting, racial varieties, and languages; (2) a substantial review of Peruvian archaeology; (3) a still longer part on the Inca nation and its institutions; and (4) a final brief resumé of Peruvian technology as revealed in textiles, pottery, metallurgy, and other industries. The plates are successful, considering their small size, in showing details of specimens and in imparting a "feel" of the immensity and grandeur of the Central Andean sites. As the length of the text would indicate, there is more information here for the student than in the recent book by G. H. S. Bushnell (1956, *Peru*, Thames, Hudson). In consequence, I think Mason's book would make a more suitable college level source whereas Bushnell's strikes me as somewhat better for the less sophisticated "popular" market. For other syntheses which are comparable in scope and similar in vein to that of Mason's the reader should consult, in addition to Bushnell's book, Bennett (1946, The Archaeology of the Central Andes, *Bureau of Am. Ethnol., Bull.* 143, Vol. 2, pp. 61-148) and Rowe (1946, Inca Culture at the Time of the Spanish Conquest, *Bureau of Am. Ethnol., Bull.* 143, Vol. 2, pp. 183-330).

Before passing on to particulars let me state that I am, in general, in accord with Mason's presentation of Peruvian prehistory as well as with many of his interpretations. But in this connection it should be explained that Peruvian archaeology is now at one of those points where there is a relatively high degree of agreement among specialists. This state of affairs, if we may judge from the history of archaeology elsewhere, and from certain signs now on the horizon, is probably the calm before the

storm. There is at this writing a spate of new field work going on in Peru as well as various museum reanalyses of earlier data; these activities almost certainly will result in critical evaluations and new interpretations. Just how much of the present structure will stand is difficult to estimate, but it is a fairly safe guess that all Peruvian archaeologists will be in for some surprises. In my remarks which follow I will emphasize certain points, both small and large, around which there are already areas of disagreement. For the most part, Mason has shown an awareness of debatable issues and has been conscientious about calling attention to them, but there are some which he has not pointed up which seem to me to be of importance.

Two of these concern chronological alignments or relative dating and are basic to area-wide interpretations. In the earlier time ranges the correlation of north and south coast sequences hinges upon the significance of the Chavinoid elements in south coastal Paracas Cavernas pottery. Mason, in his chart, follows the opinion which I have held — that of placing Cavernas as later than the Chavín horizon, on a level with north coast Salinar. Although the available radiocarbon dates seem to support this, other authors, including Kroeber (1953, Paracas Cavernas and Chavín, *Univ. of Cal. Publs. in Am. Arch. and Ethnol.*, Vol. 40, No. 8), have been inclined to equate Cavernas with Cupisnique and Chavín. Quite recently, the discoveries of associations of definite Coast Chavín type sherds with those of Paracas Cavernas style tend to support the earlier relative position of Cavernas (Rowe, 1956, Cultural Unity and Diversification in Peruvian Archaeology, paper presented at the 5th Internat. Congr. of Ethnol. and Anthrop. Sciences, Philadelphia; E. E. Tabío, 1955, Excavaciones en Playa, Costa Central del Perú, *Dirección de Arqueología e Historia del Perú*, Lima). This is not a mere detail for upon it hangs the whole history of the presumed diffusion of pottery from north to south along the Peruvian coast. Another crucial and arguable sequence placement is that of Classic Tiahuanaco on the Expansionist period level. This equates that great site, with its sculptures and classic style pottery, with the horizon spread of Tiahuanacoid-Huari design motifs. This may be correct, but there is also the good chance that Classic Tiahuanaco at the type site is appreciably earlier than Tiahuanacoid as a horizon style. In both of these instances, let me reiterate, Mason's choices are as good as the alternatives. I am simply pointing to the fact that alternatives exist and that here are places in the structure of synthesis that may be pried open by new information.

On a somewhat higher level of inference, I think that there is accumulating evidence, on both the north and central coasts, that the planned architectural units of late times first appeared with the Tiahuanaco horizon, or during the Expansionist period, rather than with the Urbanist period as Mason implies. If so, it would indicate that the artistic revolution of Tiahuanacoid times had profound sociopolitical correlates. A related question is that concerning population maxima for prehistoric Peru. If I understand Mason (p. 88) correctly, he feels that a maximum population density was not reached until Expansionist period times. The implications of this are that Peruvian societies increased steadily in size until demographic pressures touched off the presumed military and political expansionism of the Tiahuanacoid horizon. Actually, the data from the Virú Valley, the only place where a detailed attempt has been made to study population size fluctuations over the span of archaeological time, indicate that the maximum was achieved at the end of the Experimental or the beginning of the Florescent period (Willey 1953, Prehistoric Settlement Patterns in the Virú Valley, Peru, *Bureau of Am. Ethnol. Bull.* 155, pp. 390-5). Sociopolitical inferences to be drawn from this might be quite different.

Finally, on a still higher level of generalization and abstraction from the archaeological findings, I would disagree with Mason's (p. 14) statement: "It is coming to be realized that, with only minor deviations, practically all of the great ancient civilizations of the world developed along more or less the same lines." Although I have taken the stand that there are some interesting parallel configurations in the development of Peruvian and Middle American civilizations (Willey 1955, The Prehistoric Civilizations of Nuclear America, *Am. Anth.*, Vol. 51, No. 3, pp. 571-93; Willey and Phillips 1955, *Method and Theory in American Archaeology*, Chicago), I have also emphasized that there are some very distinct differences between what happened in these 2 areas as well as between regions in either area (Willey 1950, Growth Trends in New World Cultures, in *For the Dean*, pp. 223-48). There are, indeed, such similarities in the growth of Peruvian, Middle American, and Old World civilizations as the increase and stability of populations assimilating an agricultural economy, in the spread of common crafts and techniques in early pottery making, agricultural periods, and in the building of true civilizations on this base. But the forms which these civilizations take are quite unique. Only from a very remote, almost extraterrestrial point of view can we say that they are the same. When we examine them on a scale which is commensurate with human values and human experience, I think we must admit that the life of a member of the old Moche society and that of his opposite number in a Classic Maya community must have been pretty different.

As noted, I have focused attention upon a selection of disagreements rather than upon shared opinions. But it must be acknowledged that Mason was writing not primarily for Peruvian archaeologists, but rather for more general readers. To all of them I can recommend his book as a very good introduction to the subject.

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Archaeological Evidence of Pre-Spanish Visits to the Galápagos Islands. THOR HEYERDAHL AND ARNE SKJÖLSVOLD. Memoirs of the Society for American Archaeology, No. 12, Salt Lake City, 1956. viii + 72 pp., 48 figs., 2 tables. $1.00.

It has to be emphatically stressed right from the beginning that it is difficult for me to evaluate Heyerdahl's and Skjölsvold's research on the Galápagos without having personally inspected the objects recovered and compared them with the Peruvian material which serves as the basis for the datings made.

With very few exceptions the Galápagos ceramic material consists of plain ware. Hence one is immediately struck by the absence of pottery with painted decoration. Nor are sherds from vessels of Incaic shape included in the lot. Thus, there is no evidence of any kind whatever bearing on the invasion of an island far off the Peruvian coast in the reign of the Inca Tupac Yupanqui which is mentioned by the Spanish chroniclers. Neither does the material include any sherds with the polychrome decoration and the figure style so typical of the Tiahuanaco culture. Some sherds with a single painted line but without any clue to the vessel's shape are deemed fit for the label "Tiahuanacoid polychrome," but this identification seems to me a rather daring one. Consequently, the material does not furnish any direct confirmation of the theory launched elsewhere by Heyerdahl that Polynesia was settled by a Tiahuanaco-derived people, or that in the process the Galápagos Islands were used as a stopover. A few sherds with relief ornamentation certainly have more obvious resemblances with pre-Spanish Peruvian and Ecuadorian materials. However, this kind is of late date in South America. In the Desaguadero area, for example, Inca shapes and decorative style persisted unchanged long after the Spanish Conquest.

Then, there are a couple of flint objects which are called scrapers. However, they show a striking resemblance to worn-out gun flints. A petrographic examination for determination of the origin would have been desirable here. The appearance of a retouched obsidian object may be explained by the fact that in the Peru of early colonial days iron was very precious, especially since the Galápagos are volcanic and obsidian consequently should appear there. Nondecorated pottery is a hazardous enough starting point for datings, but the other material items which are supposed to speak for Indian visits to the Galápagos in pre-Spanish times appear to me to be equally precarious. My impression is that these objects are post-Columbian. It should be noted that Spanish pottery has always been found in association with the aboriginal ware which is offered by the authors as evidence of pre-Spanish contact. The visits in colonial days that happened to be recorded were probably not the only ones. Radiocarbon datings are unfortunately missing.

In a previous paper (Did the Indians in Chile Know the Use of Sails in Pre-Columbian Times?, *Southwestern Jour. of Anth.*, 1956, Vol. 12, No. 2, pp. 154-6), I showed that the sole archaeological proof of the use of sails on the South American West Coast in pre-Columbian times was the result of a misinterpretation. Moreover, the statements of the Spanish chroniclers regarding the use of sails refer to the northern part of the South American West Coast which suggests that sails came into use as a result of indirect contact with the whites. Of the hundreds of archaeological pre-Columbian figure vessels and fabrics from the more southerly coastal area there isn't a single depiction of a craft with sails. Thus the sail, like poultry, must have arrived in Peru from the north before the whites themselves.

The use of sails and a thorough familiarity with the maneuverability and capacity of sail-equipped log balsas must have been the essential prerequisite for Indian travel to the Galápagos. However, Benzoni's picture, the earliest we have of a log balsa with sail, shows that the sail was rigged in a manner to exclude just those sailing maneuvers in conjunction with *guaras* which Heyerdahl presupposes in this case (1957, Guara Navigation: Indigenous Sailing Off the Andean Coast, *Southwestern Jour. of Anth.*, Vol. 13, No. 2, pp. 134-43). Although *guaras* do not appear in this earliest picture, Ulloa's 18th century picture and other more or less contemporaneous ones show a rig and sail-setting which render such maneuvers feasible. The rigging here surely betrays European influence. The present-day Ecuadorean balsa rig is of a type identical with that of the *jagandas* used on the coast of Brazil, a craft which is also equipped with a simple centerboard device.

The *guaras* and paddle-like objects found in Peruvian graves are as a rule too richly ornamented to have seen practical uses. Those specimens which lack ornamentation and therefore may have been utilitarian objects strike me as being made of wood so heavy as to preclude floating even in an extraordinarily dry condition. The Ethnographical Museum of Gothenburg is in possession of a *guara* identical in shape with that shown by Heyerdahl in the center of Plate 75 in his *American Indians in the Pacific* (Stockholm, 1952), thus a nondecorated guara meant for practical use. The specimen lacks number and data as to provenance but is included in a collection acquired by the Museum in the '20's. The blade itself has a couple of smaller sections of the surface charred, which, in conjunction with the fact that the object has been lying in dry ground for centuries, suggests that it at present possesses maximum buoyancy. The following test was carried out: the object was immersed in an inlet just behind the Ethnographical Museum in Stockholm, where the water is salty only on occasion. The *guara* at once began to sink. When, after a minute, it was taken up, the heavier top end had already shown a tendency to disappear below the surface. It is difficult to conceive that for navigation off the Peruvian coast with assurance of returning to the starting point one could have been exclusively dependent on a piece of equipment which, if washed away and lost, would have made the balsa nonmaneuverable. A determination of the timber and practical tests with newly made *guaras* of the same timber would be of great interest.

Little is known about these paddle and *guara*-like objects beyond the fact that they are encountered in graves. It would be difficult to prove their association with a coastal population dependent for its living on the sea, but it might be possible to connect them with the agricultural people of the seaboard. Their explanation as ceremonial spades is therefore nearer at hand.

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Cultura Diaguita Chilena y Cultura de El Molle. F. L. Cornely. Editorial del Pacífico, Santiago de Chile, 1956. 223 pp., 50 illus.

In this volume Cornely reports the findings of 27 years of excavation, mostly in cemeteries, in the Diaguita area of Chile. In his capacity as Director of the Museum of La Serena, he has been more closely associated with the archaeology of this region than any other person, and his descriptions of Diaguita and El Molle have been widely circulated among Andean scholars. Cornely presents little that is new about the Diaguita in this book; he has already published most of the information in the *Revista Chilena de Historia Natural*. Nevertheless, his comparisons of Chilean and Argentine Diaguita and his division of the Chilean development into 4 stages represent contributions which should now receive wider circulation.

Ricardo Latcham first applied the Diaguita designation to the early cultures in the area between the Choapa and Copiapó rivers principally because when the residents of the region were contacted by the Spanish they were using a dialect which was intelligible to Diaguita speakers from the Argentine provinces of Jujuy and Catamarca. Latcham further maintained that the people of this zone of Chile were similar in physical type to the Argentine Diaguita.

Cornely disagrees with Latcham concerning physical likenesses, asserting that too few studies have been made to justify comparisons along this line. He also questions certain of Latcham's archaeological similarities. For example, he points out that burial urns, the commonest decorated pottery form in Argentine Diaguita, are rare in Chile. Furthermore, Chilean urns differ slightly from the Argentine variety and apparently were not used for infant burials. According to Cornely, the ceramics of the Chilean Diaguita region were technically superior to those of Argentina, included different designs, and emphasized different forms.

Cornely confirms the fact that a number of Chilean copper objects are like those uncovered in northwest Argentina. However, similar items are reported for other Andean cultures and their presence in Chile need not represent borrowings from the Argentines. He points out that the "knuckle duster" which according to Lothrop is typical *only* of the Diaguita is more common in North Chilean sites than in the Chilean Diaguita area and that they may have been diffused from the north rather than from the east.

Lacking data to controvert historical linguistic connections between the 2 zones, he suggests that the Chilean culture may represent an offshoot of Argentine Diaguita which developed distinctive traits in a new habitat. He does observe that more Diaguita place names are found today in the Chilean province of Atacama than in the region between the Choapa and Copiapó rivers.

Cornely postulates a 4-stage development for Chilean Diaguita: archaic, transitional, classic and Inca-influenced. The first two are represented in only a very limited area and by a small number of vessels and graves. The classic is widespread and contains most of the elements regarded as typical of the culture. The final stage is common in the northern part of the area and includes such items as the diagnostic Inca aryballoid pottery form.

Ceramic designs and forms characterized as Chincha-Atacameño by Uhle, Latcham, and others first appear in Cornely's transitional stage. This Chincha-Atacameño concept has been questioned by Bird, Schaedel, and Munizaga, who point out that true Chincha forms and designs are not found in North Chilean pottery. Nevertheless, certain colors and designs in Chilean Diaguita bear resemblances to Middle Ica-II pottery in the Ica and Nazca (if not the Chincha) valleys of Southern Peru. Some scholars attribute these Ica developments to stylistic influences from Coast Tiahuanaco-B. The possible extension of Tiahuanaco or Ica elements to this region of Chile should constitute an important topic for investigation by Andean archaeologists.

Cornely puts his El Molle culture earlier than Diaguita. However, this placement rests on such shaky premises as ceramic technique and condition of skeletal material. No well-stratified sites indicating the relative placement of the two cultures have been excavated. Characteristic of El Molle are lip plugs, stone pipes, the use of metal, and unpainted (sometimes incised) and polished black or gray pottery. The cranial vaults of El Molle skeletons are extremely thick, sometimes measuring 10 mm. Recent excavations by Schaedel near San Antonio show a southern extension of El Molle into Chile's central valley. There is also evidence for a northerly projection into the province of Atacama. Cornely makes no attempt to compare El Molle with cultures to the north, although there are elements in Chiripa and Paracas which are similar. These northern developments apparently antedate Classic Tiahuanaco.

The principal service of this volume is that it should stimulate more extensive and better-financed research into this important Andean region. It may be expected also to add to the recently kindled interest in Chilean antiquities which has been responsible for the establishment of a center of anthropological studies at the National University in Santiago.

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Andean Excavations I. The Tiahuanaco Era East of Lake Titicaca. STIG RYDÉN. Monograph Series, Publication No. 4, Statens Etnografiska Museum, Stockholm, 1957. 198 pp., 147 figs. $10.00.

Stig Rydén is one of the few archaeologists who have been active in the highlands of Bolivia. This monograph is another of his valuable contributions, on a part of the region that has scarcely been touched archaeologically. The study deals with excavations, mainly of graves, in the provinces of Muñecas and Bautista Saavedra, bordering on Peru. His sites are high on the eastern slope of the Cordillera Real, near the headwaters of a part of the Rio Beni drainage system. The work was done in 1951-52, but collections were not available for study until considerably later. Rydén credits Carlos Ponce Sanguines with having called his attention to the archaeological prospects of the region.

The objective, as implied by the subtitle and stated in the preface, was to determine whether Tiahuanaco influence had reached the remote valleys of the region. Rydén shows that it did, but not in strength comparable to that to be found, for example, in the Cochabamba district. Very briefly, he recovered a sequence that begins at what is pretty certainly Decadent Tiahuanaco times, and culminates in Inca and early Colonial. Tiahuanaco influence is most apparent in sherds from the bottom levels of pits; some may have been imported directly from the Titicaca basin. Vessels from the earliest graves are less obviously Tiahuanacoid, but they do share certain features of shape, color and less obviously, of design, with the later phases of Titicaca basin Tiahuanaco. It seems to the reviewer that the order of resemblance to the Titicaca basin style is comparable to that displayed by the Churajon pottery found in the neighborhood of Arequipa, on the west slope of the Andes, west of the Titicaca basin.

Later graves strongly resemble slab cist burials found in the lake basin, and produced pottery that is closely comparable to Collao Black-on-Red and Allita Amaya Polychrome, described by Marion Tschopik and duly noted by Rydén. Comparisons are also made with Nordenskiöld's material from the Peruvian eastern slope. Not unnaturally, much less Tiahuanaco influence is discernible in this more northerly district.

Rydén's reports have been of great value, but they are difficult to use because he deals with specimens grave by grave and pit by pit, without summary classification or quantitative analysis. Comparative statements are made both in connection with description and at the end of the report, so that, although he presents very complete data, one has to do a good deal of literary digging in order to use it for detailed studies.

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The Political Geography of the Yucatan Maya. RALPH L. ROYS. Carnegie Institution of Washington, Publication 613, Washington, 1957. iv + 187 pp., 17 maps. $1.60 paper, $2.00 cloth.

This is a study of the 16 petty states, usually named provinces, of the Yucatán Maya at the time of the Spanish conquest. After a brief sketch of Yucatec social and political organization, the bulk of the book takes all 16 provinces one by one and describes their boundaries and settlements, gives data on population and a sketch of each province's history, identifies the type of political organization and the names of the rulers, and discusses the distribution within each province of the various patronimics which identified exogamous patrilineal clans. There is a map for each province.

The author finds 3 forms of territorial and political organization. In one, the province was ruled by a single chief who was the head of his town and to whom the heads of all other towns in the province were subject. In the second type there was no single ruler of the whole province but most heads of towns were members of the same clan. In a third type the provinces were considered geographical units of some sort and included apparently loosely allied towns.

One of the subjects most thoroughly covered is the distribution of patronimics throughout the various provinces. These patronimics — more than 250 — are always found throughout different towns and with few exceptions in different provinces. Every town always included a large number of different patronimics and there is a hint of town endogamy. The patronimics of some provincial rulers were widely spread throughout the peninsula and not only in the provinces where the rulers carried that name. In other cases, a ruler's patronimic is found only moderately represented in his own province and very rarely outside of it.

This is an excellent documentary study in which a mass of detailed, fragmentary data from Colonial historical and administrative documents are made to bear upon the political and territorial organization of Yucatán at the time of the conquest. There is little of direct archaeological significance. A few sites are mentioned but the whole problem of the sites of the Yucatec Maya of this period has already been discussed by Roys (1952, Conquest Sites and the Subsequent Destruction of Maya Architecture in the Interior of Northern Yucatan, *Carnegie Inst. of Washington, Publ.* 596, *Contribs. to Am. Anth. and Hist.*, Vol. 11, No. 54). By throwing additional light upon Yucatán between the fall of Mayapán and the Spanish conquest, the only period for which we have ethnographical descriptions of the pre-Spanish Maya, this study should further impress upon the archaeologists the need for new efforts to obtain archaeological information about that same period.

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Ceramic Sequence at Uaxactun, Guatemala. ROBERT E. SMITH. Middle American Research Institute, Publication No. 20 (2 vols.), Tulane University, in co-operation with Carnegie Institution of Washington, New Orleans, 1955. Vol. 1: viii + 214 pp., text illus., 23 tables, 2 charts, 2 maps; Vol. 2: viii pp., 86 figs.

This long-awaited report is the last of 4 major studies of the site of Uaxactun, an important Maya ceremonial center in the tropical rain forest of the department of El Petén, Guatemala. Discovered by Morley in 1916, the excavation of the site was undertaken by the Carnegie Institution of Washington during the years 1926 to 1937. Publications have already appeared, describing the excavations, by Ricketson and Ricketson, in 1937; the artifacts, by Kidder, in 1947; and the architecture, by A. L. Smith, in 1937 and 1950. In addition, in the excavation report of 1937, Mrs. Ricketson studied and published the pottery found in Group E during the years 1926-31. However, except for this and 2 preliminary mimeographed pamphlets by Robert Smith, published in 1936, the report here reviewed is the first detailed information on the ceramics of the site as a whole.

Smith's report is presented with all the care and clarity which are characteristic of Carnegie and Middle American Research Institute publications. The reviewer is particularly pleased with the 2 volume arrangement since it permits the easy study of the illustrations and text simultaneously. Special credit is due to Antonio Tejeda Fonseca, Victor Lucas, and Roberto Gonzales for the splendid paintings and drawings of Uaxactun pottery which are carefully reproduced in black and white in the second volume. Smith has devised an excellent key to color symbols used in these illustrations, but in spite of the cost of color plates it is unfortunate that at least a few could not have been presented to give the reader who is unfamiliar with the splendor of Maya polychrome pottery some idea of the vivid and dramatic use of paints and stucco.

The textual part, Volume I, begins with a review of the excavation; a general summary of Uaxactun ceramic periods, wares, techniques of decoration, and types of design; a review of mortuary, cache, and special vessels; and a study of dating by means of the association of stelae, architecture, and pottery. Part II, the analytical section of Volume I, is devoted to a detailed description of the pottery, phase by phase, based on vessel forms rather than on wares.

After presenting the stratigraphical problem of Uaxactun, Smith discusses the important diagnostics of each Uaxactun archaeological phase: Mamom, Chicanel, Matzanel (a new transitional phase between the Formative and Classic periods), Tzakol I, II, III, and Tepeu I, II, III. The diagnostics of each phase are discussed from the point of view of wares, forms, decorative techniques, and designs. This admirably concise section is enhanced with some technological notes by Anna O. Shepard which will be of great use to archaeologists for comparative purposes. The Uaxactun wares are divided into 3 categories: the coarse and fine wares and the miscellaneous and special wares. Probably the best section of the entire report is that which concerns the methods of decoration and the types of designs. Smith's classification of decorative techniques into surface alterations (modeling, incising, gadrooning, chamfering, fluting, notching and so forth) and surface additions (painting, slipping, stuccoing, appliqué, and so forth) is unique in its perception and clarity and will surely open a new chapter in pottery classification. His design classification (abstract, conventionalized, naturalistic, glyphic) is refreshing to read and minutely precise in definition. By using such imaginative and easily visualized and remembered terms as "dress-shirt," "sausages," "double yoke," and "hand bell," he has broken away from complex definitions which leave the reader more bewildered than informed. It is greatly to be hoped that this new design classification will be adopted by other archaeologists.

Special mention should be made of the section (pp. 105-8) dealing with the dating of pottery by means of stelae. This technique of correlating architecture and pottery by means of dated stelae was devised by the Smith brothers and discussed by A. L. Smith in 1950. Although it is not considered infallible, it should prove to be particularly useful in cases where C-14 samples are not available.

In Part II Smith gives an analytical treatment of pottery forms and wares by periods. This section includes a wealth of comparative material from other sites in Guatemala as well as from the whole of Mesoamerica. An index of sites (pp. 212-4) and an appendix listing all sherds from all stratigraphic cuts are useful additions.

The only criticism on the part of the reviewer concerns the cautious section entitled "Comments and Problems" (pp. 5-8). Smith's historical conclusions and interpretations of native life are far too brief and noncommital, as compared with the wealth of material presented in the report. It is hoped, however, that his forthcoming report of the Uaxactun figurines and effigy whistles will include the much needed ethnohistorical data and will give a more detailed reconstruction of Maya ceremonial and daily life. This criticism notwithstanding, the present contribution remains one of the best reference sources on Maya pottery. It should serve as an exemplary guide book for future ceramic studies in Mesoamerica and elsewhere.

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Las Antiguas Creencias en San Miguel Sola, Oaxaca, México. HEINRICH BERLIN. Beiträge zur mittelamerikanischen Völkerkunde, Hamburgischen Museum für Völkerkunde und Vorgeschichte, No. 4, Hamburg, 1957. 50 pp.

This monograph brings to light Spanish Inquisition records of the 17th century on the survival of paganism in Oaxaca. Heinrich Berlin, authority on Mexican docu-

mentary history, discovered these records in the Ramo de Inquisición del Archivo General de la Nación de México. Mexican Indians were supposed to have been excluded from the Inquisition since they were just learning the Christian faith. But in 1656 Father Balzalobre published his explosive book on Oaxacan idolatry, *Relación auténtica de las Idolatrias, Supersticiones, vanas Observancias de los Indios del Obispado de Oaxaca*, which created a furor in the Inquisition tribunal of the city of Mexico. The tribunal conferred the title of Inquisitor upon the bishop of Oaxaca in March, 1659, and authorized his Inquisition tribunal to proceed against Indians. The bishop was instructed to take testimony documenting various unsubstantiated reports of idolatry. The documents containing testimony on idolatry in the Oaxacan village of San Miguel Sola are those summarized by Berlin. By July, 1659, the Holy Office of the Inquisition had suspended the prosecution of Indians and in 1661 the original documents containing Indian testimonies were sent to the *comisario* in Oaxaca.

Berlin's monograph constitutes a supplement to Balzalobre's *Relación*. Berlin states that the Inquisition documents produce a far more complete picture of the Indian beliefs of Sola in the mid-17th century than did Balzalobre who selected only the most important cases and viewed everything with the religious bias of his time. Berlin's meticulous research has yielded some new details but few new insights into Oaxacan Indian religion or the history of culture change in Mexico. Berlin made no attempt to analyze the significance of his Oaxacan material for the broader study of the nature and processes of culture change. A statement of conclusions by Berlin would have been useful.

The monograph contains sections dealing with pagan gods, priests, calendars, divining, marriage, birth, death, sickness, agriculture, hunting, and fishing. The section on gods is of interest to Mesoamerican archaeologists and culture historians.

Religious syncretism evolved very slowly in Oaxaca where the Indians maintained 2 separate religions — paganism and Catholicism — for more than a century after the Spanish Conquest of Mexico. Pagan worship was carried out secretly or disguised as Christian ritual before the eyes of Catholic priests. Secret rites included animal sacrifices to pagan deities, ritual baths, fasting, and sexual abstinence. Disguised paganism centered around the practice of making candle offerings at Catholic church altars to pagan deities. Thus offerings to the pagan goddess Nohuichana were placed on the altar of the Virgin del Rosario while offerings to the god Coquielaa were put in front of the image of San Juan. In these instances the Oaxaca Indians apparently did not think of the Catholic saint and the pagan god as the same deity in the way that Indians of the Valley of Mexico identified Tonantzin, the Aztec earth goddess, with the Virgen de Guadalupe. Instead the Oaxaca Indians used the Catholic saint's image as a camouflage for worship of a distinct pagan deity.

The pagan cult was focused on a pantheon of 13 gods who governed the 260 days of a sacred calendar corresponding to the Aztec tonalpohualli. Names and basic functions of the 13 gods listed by Berlin are virtually the same as those recorded by Balzalobre. Berlin adds some previously unpublished information on the role, function, and worship of the 13 gods. He believes that Liraquitzino, whose name means "The Thirteenth God," must have resembled a supreme deity for he intervened in all aspects of life and was highly esteemed. His offerings consisted of 13 candles or 13 pieces of copal. When the Indians made offerings to the Thirteenth God in the Catholic church they distributed the 13 candles among all the altars. Balzalobre calls the Thirteenth God "Leta Aquichino" and says of him only that he received sacrifices in connection with dreams and omens.

Both Berlin and Balzalobre identify Loçio as the god of lightning who received sacrifices on the occasion of cutting the first chile. Berlin writes that Loçio was one of the most important gods because he sent rain for the growth of crops. He was particularly the god of chile but Berlin believes that Loçio became the general god of the harvest of maize and chile, replacing Loçuqui as god of maize. Other gods of the Oaxaca pantheon were: Coqueelaa, god of *nopales* and god of riches to whom traveling merchants made sacrifices; Lexee, god of witches; Licuicha Niyoa, god of hunters; Cosana, god of ancestors who lives in deep waters where he receives offerings from fishermen; Nohuichana, goddess of life invoked at birth and death; Leraa queche and Liraa cuee, gods of medicine; Nonachi, god of sickness; Leraa Huila, god of hell who receives sacrifices at time of death; and Xonatzi Huilia, wife of the devil.

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Stone Artifacts at and near the Finley Site, near Eden, Wyoming. LINTON SATTERTHWAITE. Museum Monographs, University Museum, Philadelphia, 1957. iv + 27 pp., 5 figs., 3 tables. $0.75.

When reviewing the 1951 publication of Moss and others on *Early Man in the Eden Valley*, in this journal (1955, Vol. 20, No. 3, pp. 302-4), I pointed out that it was a shame to send such an excellent work to press without an adequate study of the artifacts, and that the University Museum should prepare such a study.

Satterthwaite, famous as a Mayan archaeologist, has now responded with what is unquestionably the most complete publication we have on the artifacts from an "Early Man" site in America. By drawing together the field notes and observations of the 5 persons who did archaeological work at the Eden site in 1940-41 (Finley, Cook, Howard, Bache, and himself), Satterthwaite has answered about every question possible on the artifacts and their provenience. At considerable trouble, he relocated every artifact except 2 projectile points in the Cook collection.

Six principal stations (A-F) were recognized at the

Eden site proper, plus several "miscellaneous" stations nearby. Four major stratigraphic levels were defined, of which the uppermost was loose sand, while the other 3 were the Upper, Middle, and Lower sands as described by Moss. Satterthwaite has now compiled all available information on the position of each specimen in relation to the stations and the strata present at each station, also taking into consideration such factors as erosion where one or more strata were missing, and the possibility of intrusion of artifacts into or onto strata other than those in which they were originally deposited. Ground plans of the site and excavations are provided, and there are discussions of dating, recommendations for future work, and so forth.

Every artifact is illustrated, both with clear photographs and with outline drawings. Certain discrepancies in the identification of artifacts by catalog number, noted in the preliminary reports, have been corrected. The typological identifications have been brought up to date, so that there remains little doubt that those projectile points designated as "Eden points" and "Scottsbluff points" are now correctly identified. I would add that specimen A-11, which bears only a question mark as to its type, is probably an Eden point, for I was able to examine all the specimens with Satterthwaite in 1956.

Only one mild objection may be made: the identification of 4 specimens by a third designation, "Broad Flat Triangular." The outlines (Fig. 1) and photographs (Fig. 4) show quite plainly that these 4 artifacts are merely the blades of projectile points which once had stems, broken off long ago. The blade parts appear to me to belong to Scottsbluff points, which, if true, would bring the total of Scottsbluff points to 13 (including the 2 "Scottsbluff Variants") as against 7 Eden points (including that designated with a question mark as mentioned above).

Two classic Folsom points, a "Cody Knife," a drill, and several other artifacts were found as well, but not at Station A, which provides the type locality for the Eden-Scottsbluff complex associated with the Middle Sand. This sand reflects a "moderately wet" climatic period, for which the age estimate of 7000 to 9000 years ago appears entirely reasonable. There are no comparative notes on other sites, but this is no serious lack, since Satterthwaite has provided such painstaking notes on the Eden site situation.

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Late Mogollon Communities: Four Sites of the Tularosa Phase, Western New Mexico. PAUL S. MARTIN, JOHN B. RINALDO, AND ELOISE R. BARTER. Fieldiana: Anthropology, Vol. 49, No. 1, Chicago Natural History Museum, Chicago, 1957. 144 pp., 57 figs., 5 tables. $4.00.

This paper completes an even dozen reports by Martin and his associates covering more than 15 years of study of the Mogollon culture in the Reserve area of New Mexico. Like its predecessors, it meets an unusually high standard in organization and form. The data are assembled in an orderly manner, the illustrations are excellent, the comments and conclusions are expressed with an admirable lack of verbosity and fog, and the authors can hardly be too highly commended for promptitude in making available their results.

The book comprises reports on excavations during 1954 at 3 sites in the Reserve area, assigned to the Tularosa phase, about A.D. 1100-1200. In addition, a section is devoted to the ceramics and burials of Jewett Gap pueblo, a Tularosa site excavated earlier by Deric O'Bryan for Gila Pueblo. Each of these sites contributes its bit in amplifying the story of life among the Mogollones during the Tularosa phase.

An important feature of the work was the excavation of 2 great kivas and 1 "pithouse kiva" at Higgins Flat pueblo, a site that had previously been partly excavated (*Fieldiana: Anthropology*, Vol. 45). The earlier of these kivas (possibly of the Reserve phase) was D-shaped, the later was rectangular. Each was about 10 by 10 m., walled with masonry, and characterized by long ramp entrances. Few such structures are known, and their importance as possible ancestors of Anasazi great kivas is obvious.

Nine rooms of a pueblo near Apache Creek and 2 rooms of another near Aragon were excavated. Among unusual features noted was the use of large pottery meal receptacles buried at the lower ends of mealing bins. Each pueblo contained one room with a ventilator but with no other usual kiva details — raising the question of possible ceremonial purpose.

An explicit description of the architecture is presented by Martin, followed by a remarkably complete and carefully systematized discussion of artifacts other than pottery by Rinaldo. The latter classifies his 457 objects according to the usual nomenclature into 98 categories, but he manages more nearly than most writers in the dismal field of lithic statistics to make his quantities and measurements interesting. Certainly almost every element of information that even the ardent disciple of the conjunctive method could desire is readily available from his tables, photographs, and text. Inferences are not startling, but confirm the conclusion of a long continuity in Mogollon material culture in spite of a few late modifications, such as beveled manos, triangular side-notched points, rectangular stone bowls, and grooved axes.

The third section is a discussion by Mrs. Barter of the ceramics from the 3 sites. The collection contained 44 whole vessels and about 15,000 sherds, and its study made possible a clearer ceramic differentiation between the Reserve and Tularosa phases. The discussion of this material is informative, but the presentation would be more valuable if the vessels had been more fully treated. Most are referred to merely by type name, without dimensions or descriptions, and only 2 are illustrated. Furthermore none of the sherd material is illustrated, which is a pity, especially in an area where so much typological subtlety and proliferation of nomenclature have evolved.

To all but the specialist the statistical data based on 53 named types and variants will be confusing.

Barter discusses the "trends in popularity" of several local types as a basis for chronological seriation, and since no reliable treering dates are available for this region, absolute dating is largely inferred from trade pottery. Because such sherds here are not numerous, conclusions based on them must be somewhat provisional. Barter's list of 5 "guide types" as an assemblage for distinguishing the Tularosa phase is helpful, but her reference to several variants of St. Johns Polychrome could be more fully spelled out, especially the variant that "may have been locally made."

In the fourth section Barter discusses 265 whole and restorable vessels from Jewett Gap, a pueblo of over 40 rooms and 62 burials. Sadly, the vast sherd collections and data upon them were lost after their removal to Gila Pueblo and before she had opportunity to study them. Her published report is a condensation of a master's thesis at the University of Arizona, and it omits some valuable data contained therein. As published, the vessels are mostly listed only by type names, but are more fully described in the thesis. Furthermore the thesis propounds an interesting approach to ceramic analysis in terms of "cultural entities" (that is, the "grouping of artifacts that were consistently placed together by the prehistoric inhabitants") and the correlation of features observable by the archaeologist with those recognized by the makers. This essay might have been retained. The report presents illustrations of only 12 painted vessels, although the thesis contains 42 others. There would have been great value in a fuller presentation of these.

The discussion of ceramic associations of 215 pots in the burials is interesting, and some significant correlations are adumbrated: close similarities of specimens in a single burial, suggesting a single potter; culinary vessels mostly with females, prognosticating woman's post-mortem failure to escape the kitchen; eccentric and miniature vessels associated with children.

Martin's summary finishes the book. He draws together cogently the results of the work in the area, outlines general trends of development, poses a few unsolved problems, and hazards a few guesses. The footsteps of the retreating Mogollones, leaving their homeland in the 14th century, have not been traced, but if Martin is correct their clans may now be forgathered at Zuni. We are grateful to the authors for painstaking achievement and we look forward to further word from them on the long trail north.

WATSON SMITH
Peabody Museum West of the Pecos
Tucson, Ariz.

Richard Wetherill: Anasazi. FRANK MCNITT. University of New Mexico Press, Albuquerque, 1957. xii + 362 pp., 4 drawings, 16 photographs, 4 maps. $10.00.

This biography of Richard Wetherill resolves itself into a study of excavating and collecting methods at the turn of the century, particularly in the Mesa Verde and Chaco Canyon areas, and an earnest defense of the part played by Richard Wetherill in this early work. The author says of him: "It has been his misfortune that certain scientists have been severe in their criticism of him, if a gentle term may be used, because he failed to employ techniques which were not devised until a generation after his death."

The author points out that the sale of "relics" was usual and that *The Archaeologist* maintained a regular Collector's Department. He quotes the editor, Warren Moorehead, on the ethics of collecting. Moorehead condemned vandals who failed to record their observations, but said legitimate workers could sell collections or parts of them so long as there was no "destruction of scientific testimony."

Convincing evidence is presented of Richard Wetherill's care and growing skill in note taking, and his desire, often almost wistfully expressed in his letters, for instruction in the most recent and authoritative methods.

The strength of the book lies in the immense amount of basic documentary material the author has been able to dig up. Acknowledgments are made to the American Museum of Natural History for Richard Wetherill's field notes for the 2 Grand Gulch expeditions, the Wetherill-Pepper-Hyde correspondence, and photographs taken of Pueblo Bonito for the Hyde Exploring Expedition. The Prudden papers at Yale are drawn upon. Court records, land office records, southwestern newspaper reports of the time, are all searched out and quoted in detail. These all add ballast to the interviews, which might otherwise be discounted as biased, with living friends and relatives. The solidity of workmanship makes the book a clarifying contribution to the history of southwestern archaeology.

The Mesa Verde work is discussed in detail. By March, 1890, 15 months after the discovery of Cliff Palace, Richard Wetherill had discovered 182 cliff dwellings and had named most of them and mapped the whole area. Two years later 4 collections had been taken out, all going ultimately to museums, "the first being bought by the Denver Historical Society, the second purchased by the H. Jay Smith Exploring Company and donated finally to the University of Pennsylvania Museum, the third taken to Sweden and later moved to the National Museum in Helsinki, Finland, and the fourth joined with the first and placed eventually in the Colorado State Museum at Denver." Nordenskiöld's careful methods are emphasized. Mention is made of his early use of a treering count in establishing the age, though not the dates, of the wall in Spruce Tree House through which the spruce tree grew. Wetherill learned from such direction.

Through the formation of the Hyde Exploring Expedition, early Basket Maker finds, the discovery of Kiet Siel, and pack trips with Prudden, the book moves to the tragic series of events accompanying the work at Chaco Canyon. The Wetherill period at Chaco is built up with documented detail on the complicated relations between the Hyde brothers and their company, Richard Wetherill, Pepper, Hewitt, agency and land office officials, and Nava-

hos. Impressive evidence is given of Wetherill's integrity of motive in his homesteading and excavating, and of the sincerity of his offer of his homestead with its archaeological sites to the government as a gift. The situation builds up to Hewitt's complaint of vandalism, Land Office Special Agent Pracht's defense of the work as under the American Museum and directed by Putnam, the final suspension of Wetherill's homestead entry, and the ending of the Hyde exploring activities. A tragic picture is built up of friction in high places continuing until the murder of Wetherill by a Navaho in 1910. The swift reportorial style carries remarkable tension as it presents the bitter personal antagonisms which formed the backdrop to Richard Wetherill's life and to the archaeology of the period.

A valuable account is given of the activities of the Hyde Exploring Expedition including its trading posts in Arizona and New Mexico, its stores and outlets along the eastern seaboard, its building up of a market for Navaho blankets, its evaporator plant at Farmington which exported even to Europe, so that Fred Hyde said he had been served dried fruit from Farmington in a Paris restaurant.

The book conveys the feeling of Indian country and trading post life. The vignettes of the people who drifted over that wide country at the turn of the century are often delightful and memorable. Always central, however, is the figure of Richard Wetherill, sure of his on-the-ground knowledge of the ruins, anxiously aware that he must take second place to men with the training to know what to do with his findings. That aspect of his troubled life had its inevitability.

FRANCES GILLMOR
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A Pinto Site at Little Lake, California. MARK RAYMOND HARRINGTON. Southwest Museum Papers, No. 17, Los Angeles, 1957. viii + 91 pp., 54 figs. $3.75.

This is the final report on the Stahl site, located in Inyo County, California. At Stahl the artifacts of the Pinto culture are associated with posthole patterns believed to be evidence of round or elliptical dwellings or other structures built by the Pinto peoples. In view of the age often ascribed to the Pinto artifact complex, and the wide distribution of the deeply base-notched and stemmed chipped flint classes, the possibility that the house patterns can be correlated with the Pinto specimens is as exciting as it is important.

Study and excavation of the site, done by competent amateur volunteers, revealed a complex problem in correlation of soils, old surfaces, nearby land forms, and past geologic events. The site is interpreted as being built on an alluvial fan, with occupancy continuous during much of the building up of the site. The fill, all identified as alluvial sediment of one sort or another, was deposited on a scoured-off hardpan. The level of origin — hence the relative age — of the 7 post patterns cannot be precisely determined, I take it, because the postmolds outlining the 7 patterns encountered were visible only in the first or deepest layer of sediment containing artifacts, directly above the hardpan. Two other layers of silt (also containing artifacts) uniformly sealed the postmold patterns. There is no specific mention of floors inside the post patterns. Fireplaces or fire pits were only tentatively identified. Evidence of excavated basins into which the houses were built was specifically mentioned as lacking. Hence, one presumes that the houses were built upon a higher surface which is now eroded away, leaving only the roots of the postholes and pits. This interpretation would explain the lack of signs of use in the interiors.

The postmold patterns are interpreted as Pinto houses, because Pinto points were found on all levels above the houses and in the layer where postmolds occurred. In passing, the author remarks (p. 18) that the "house" patterns are always sealed by a fine silt layer, but I can see no such thin layer in any of the photographic illustrations. However, the photographs are uniformly poor and show little detail, so my failure to distinguish the separate soil layers has little relevance.

Aside from the post patterns there were burial pits, cairns, and other man-made structures scattered through the site. The upper sediment layers had built up around some of the cairns. Whether the cairns are deemed coeval with the houses is not always clear, but in one or 2 cases the cairns appear to have been built on the surface where the postholes were first observed and, I presume, are of comparable age.

Artifacts were numerous, commonest in the higher levels, and decreasingly frequent in the lower levels. Harrington separates for discussion the following artifact classes: 27 massive and 90 thin metates, 61 unshaped and 24 shaped manos, 121 hammerstones (67 of which are unshaped), 100 barbed Pinto points, 78 square shouldered Pinto points, 152 sloping shouldered Pinto points, 132 unshouldered Pinto points, 35 one-shouldered Pinto points, 19 broad leaf points, 19 willow leaf points, 31 Lake Mohave points, 43 Silver Lake points, 16 intermediate (between Silver Lake and Mohave) points, 26 miscellaneous points, 8 knives, 108 flake knives, 36 drills (of 2 types), 288 straight-edge scrapers divided into several types, and hundreds of other scraper forms. These finds are presented in summary charts where the occurrence by arbitrary 6-inch levels is indicated.

In a summary Harrington labels the entire collection as being the "Playa culture." The Stahl site he dates as 3000 to 4000 years old, and he correlates the site with the "Little Pluvial." This age estimate is also partially derived from 2 radiocarbon dates of 3870 ± 250 and 4050 ± 300 from a cave near Moapa, Nevada. The presumed chronological equivalence of the Nevada site with the Stahl site is based on a few artifact similarities.

The report is very difficult to read because Harrington has again used the chatty style he prefers, and the facts of relationship must be diligently searched out among

irrelevancies. While I searched for all the pertinent comments I cannot be certain that I found them. The report is disappointing because the controls on the postmold evidence seem to be imprecise, and because the discussions of Pinto points and the Pinto culture generally do not extend our detailed knowledge of the projectile point styles or the remainder of the artifact complex as was to be hoped for from such a large and varied collection of specimens.

Despite the criticisms I have leveled at it, the report places the very important Stahl site on final record and will be much consulted by students of the Great Basin.

JESSE D. JENNINGS
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Salt Lake City, Utah

New Discoveries at Jamestown, Site of the First Successful English Settlement in America. JOHN L. COTTER and J. PAUL HUDSON. National Park Service, Washington, 1957. 99 pp., illus. $0.50.

Published to coincide with the 350th anniversary of the founding of Jamestown, *New Discoveries at Jamestown* is essentially a handbook for the visitor to the site, and is written to complement the exhibits to be seen there. More than that, however, it is an excellent demonstration to the interested public (and I suspect, in some instances, to the historian) of the very real contribution which archaeology can make to the documentary record of colonial life in the United States.

This short and popularly written book is divided into 2 sections. In the first, Cotter discusses the archaeological situation at Jamestown. He briefly describes the excavation history, the excavations themselves, and the types of structures indicated, various kinds of houses, churches, and workshops, together with other features such as ditches, roads, and wells.

The second section is by Hudson. His is a brief account of the details of the town and its day-to-day existence as it has been reconstructed from the thousands of artifacts in "the largest collection from any 17th century colonial site in North America." The dress, health, occupations and pleasures, food, and trade of the Jamestown citizenry are revealed by such objects as pins, drug jars, and fishhooks. These minutiae of daily life, so vital to the existence of the colony, help to bring American history more clearly to view.

The book is well designed with a pleasing format. Amply illustrated with over 100 pictures, it offers not only sharply detailed photographs of the archaeological features of the site and material recovered during the excavation, but drawings of these features and artifacts as they may well have appeared when in actual use at Jamestown during the 17th century. The drawings contribute greatly to the revivification of the site and enable the visitor to relate to his own experience events and objects over 300 years old.

Of necessity the book is not concerned with the mass of technical data desired by the archaeologist. It can, nevertheless, be considered as a preliminary statement of the 22 years of more or less concentrated effort by the National Park Service "to wrest from the soil of Jamestown the physical evidence of 17th century life." There are short descriptions of the various types of glazed ceramics found at the site, and a bibliography refers the reader to a number of published papers on specific aspects of the Jamestown research. Until a formal and over-all exposition of the work at Jamestown is available, the present summary will assist, in many ways, those concerned with problems of colonial archaeology by presenting photographs and brief descriptions of artifacts and excavated features for comparative purposes.

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Georgia Historical Commission
Cartersville, Ga.

NOTES AND NEWS

EDITED BY CLEMENT W. MEIGHAN

GENERAL

The following table is of interest in showing the distribution of members of the S.A.A. Although not all the members do their archaeology in the area of their home address, this does show the regional support given to the Society. It is noteworthy that half of the states have less than 10 members. There is in addition a sprinkling of foreign members scattered all over the world, the leading countries being Canada (24), Mexico (12), Japan, and Peru (4 each). These figures do not include institutional and library memberships.

DISTRIBUTION OF MEMBERS, S.A.A.
From October 1957 Membership List

California	129	New Jersey	10
New York	89	Maryland	8
Illinois	57	Oklahoma	8
Massachusetts	52	Oregon	7
Arizona	42	Kentucky	6
Pennsylvania	41	Montana	6
New Mexico	38	Virginia	6
Texas	32	Wyoming	5
Michigan	29	Tennessee	5
District of Columbia	24	Arkansas	4
Indiana	24	Delaware	4
Missouri	22	Idaho	4
Connecticut	22	New Hampshire	4
Ohio	21	North Carolina	4
Colorado	20	South Dakota	4
Nebraska	20	West Virginia	4
Wisconsin	17	Maine	3
Washington	16	Minnesota	3
Florida	16	North Dakota	3
Louisiana	16	Rhode Island	2
Alabama	14	Mississippi	2
Georgia	13	Nevada	2
Iowa	12	South Carolina	0
Kansas	12	Vermont	0
Utah	10		

An exhibition, "The Noble Savage, the American Indian in Art," at the University Museum, Philadelphia, will be of interest to archaeologists concerned with protohistoric and historic times, for the wealth of pictorial information brought together. The exhibit includes pictures, sculptures, and books, and artifacts pertaining to them. The exhibition opened May 8th and will continue through September 8th. A brief descriptive catalog has been prepared by Robert C. Smith of the University of Pennsylvania.

ARCTIC

Chester S. Chard, aided by a Carnegie Corporation of New York grant through Harvard University, spent the fall of 1957 visiting museums and research institutions in the Soviet Union and Scandinavia. He discussed circumpolar and circumboreal problems with various arctic specialists and had an opportunity to examine recent and still unpublished field data. Particularly noteworthy were the materials excavated by M. G. Levin during the summer of 1957 from a cemetery of the Old Bering Sea culture located at Uelen, Cape Dezhnev. Crania from this site are reported to be of classic Eskimo type, and a number of artifacts were found in situ for the first time.

Reports currently at hand indicate that the North American arctic will be extensively covered by several field parties during the summer of 1958.

ALASKA. Frederica de Laguna of Bryn Mawr College and Catharine McClellan of Barnard College will return to the Copper River Valley to resume work begun there in 1954. They will concentrate on an ethnological survey to salvage all possible data before the proposed Wood Canyon dam floods out the salmon runs and possibly obliterates the Atna culture. James VanStone of the University of Alaska has already inspected some of the archaeological sites in the area. The Atna project is supported by a National Science Foundation grant to Bryn Mawr College.

J. L. Giddings of Brown University is also returning to an area of former work, the Choris Peninsula site which he discovered in 1956. Assisted by William Simmons, an undergraduate at Brown, Giddings will excavate the remaining round pithouses situated there on raised beaches facing toward the Chukchi Sea. The project is supported by a grant from the American Philosophical Society and will include extended investigations along the successions of beach lines around Kotzebue Sound. Portions of these will be mapped and it is hoped that a correlation can be established between cultural phases and ancient strand lines.

YUKON TERRITORY. Richard S. MacNeish, Human History Branch of the National Museum of Canada, will spend his third season at the Engigstciak site on the Firth River. His major aim will be a broader survey of the Firth Valley, and he plans to walk down the river in company with Gordon Lowther of the McCord Museum at McGill University. All single component sites discovered will be tested for what light they may shed on the cultural sequence at Engigstciak.

KEEWATIN DISTRICT, N.W.T. Elmer Harp, Jr., of Dartmouth College plans to conduct a reconnaissance of the lower and middle Thelon River, extending westward from Baker Lake through Schultz and Aberdeen lakes to the confluence of the Dubawnt River and possibly into Beverly Lake. This propect is supported by a grant from the Arctic Institute of North America, and its object is to discover and identify whatever prehistoric cultural influences may have infiltrated the area and to correlate these, if possible, with the proglacial raised lake beaches which are a prominent physiographic feature there. The area may yield evidence of early tundra adaptations, pre-

Dorset Eskimo stages, and even Plains traits, such as those tentatively recognized from a site at Grant Lake on the lower Dubawnt River. Harp will be accompanied by Robert A. McKennan, Director of the Northern Studies Program at Dartmouth.

UNGAVA. William E. Taylor, Human History Branch of the National Museum of Canada, will further extend his Dorset Eskimo researches with work in sites on the east coast of Mansel Island and also around Sugluk and Ivugivik on the northern and western coasts of the Ungava Peninsula. Preliminary analysis of Dorset material obtained last year in Ungava has yielded a provisional seriation of traits ranging from proto- to terminal Dorset culture in the Hudson Strait area. Taylor hopes that his 1958 results will add to the various artifact assemblages and further clarify the middle stages of the Dorset continuum.

Assembled by ELMER HARP, JR.

PACIFIC COAST AND GREAT BASIN

IDAHO. Earl Swanson, Idaho State College Museum, is conducting an archaeological survey of areas in the Snake and Salmon rivers drainage systems under a grant from the National Park Service. Miss Hopkins, also of the Museum, has a National Science Foundation grant for a study of *Bison latifrons*.

WASHINGTON. A crew of 16 State College of Washington students under the direction of Richard Daugherty is conducting the final season of excavations in the Ice Harbor Reservoir on the lower Snake River. Two other crews from the State College of Washington are in the field this summer. Bruce Stallard, a graduate student, has a crew working in the Kalispell area of northeastern Washington. Late in the summer, Stell Newman, also a graduate student, will be in charge of a small crew working on a coastal site at Toleak Point. Both excavations are supported by funds from the Washington State Department of Conservation, with the Toleak Point excavations also receiving support from the National Park Service.

A crew from the University of Washington under the direction of Robert Greengo is continuing the excavations in Priest Rapids Reservoir begun a year ago. This work, supported by the Grant County Public Utility District, is providing significant information about this important middle-Columbia area.

OREGON. Luther Cressman is directing excavations this summer in the Emigrant Reservoir on the Rogue River, Oregon. Two of Cressman's graduate students conducted a site survey of the John Day Reservoir on the Columbia River during the Christmas holidays.

UTAH. During 1958, as in 1957, the archaeological activities of the University of Utah are concentrated on salvage work in the Colorado River Basin under the direction of Jesse D. Jennings. After a successful program the first year, the University of Utah is expanding its activities to salvage an adequate sample of the archaeological material which would otherwise be inundated behind the Glen Canyon Dam. The University of Utah, along with the Museum of Northern Arizona, has negotiated contracts with the National Park Service to do the actual salvage work in Glen Canyon. The portion of the Glen Canyon reservoir area for which the University of Utah has contracted includes the area west of the Colorado River, all of the land east of the Colorado River above the San Juan, and all of the land north of the San Juan. Two new full-time archaeologists joined the University staff this spring to take part in the program. Thomas W. Mathews, who was trained at the University of New Mexico and at Harvard, has taken charge of a survey party. Dee Ann Suhm, who received her training at the University of Texas and the University of California at Los Angeles, has become the supervisor of the laboratory which was recently completed at the University of Utah. With several parties in the field this summer, there will be a large flow of material to be processed and to have ready for analysis and reporting by the field archaeologists when they return to Salt Lake City in the fall. Field work is again being supervised by Robert H. Lister of the University of Colorado and by Jesse D. Jennings and James H. Gunnerson of the University of Utah.

Four field parties are continuing the reconnaissance of the area to be flooded. Last summer, reconnaissance was completed for the drainages coming into the Colorado River from the west, from the dam site north to and including the Escalante River and in the V formed by the San Juan and the Colorado rivers. By the end of this summer, it is hoped to have this initial survey completed, so that the over-all problem can be better assessed and plans made for systematic excavation of key sites.

CALIFORNIA. The University of California Archaeological Survey (U.C.A.S.) has test excavated in Mitchell's Caverns, in San Bernardino County, California. Although a rich and varied collection, consisting of basketry, cordage, and pottery, was taken from this cave in 1934, there has been no publication on the material and no archaeological description of the site. The recent excavations were made to provide background for the 1934 material, submitted to the U.C.A.S. by the California State Division of Beaches and Parks, which now has jurisdiction over the site. The 1958 excavation was in charge of Jack E. Smith, who reports that the present condition of the cave indicates that most of the material collected in 1934 must have been recovered from the top layers of the deposit. Bones identified as of the ground sloth (*Nothrotherium*) were recovered at a depth of 57 inches. There is no indication, however, of association of the sloth bones with evidence of man or his activities.

The Curtiss-Wright Corporation supported the complete recording of a large petroglyph site, known as the Lagomarsino site, near Virginia City, Nevada, by the U.C.A.S. R. F. Heizer, M. A. Baumhoff, and A. B. Elsasser carried out the field work and analysis of elements. Two styles of petroglyph, curvilinear and rectilinear, have been disclosed, indicating a long period of use of the site and probably representing occupation by 2 different prehistoric Great Basin groups.

J. L. Nichols and E. R. Prince excavated at a Buena Vista Lake site dug and reported on by W. R. Wedel in 1941, and at the Rincon Creek site on the Santa Barbara coast, excavated by D. B. Rogers and by R. L. Olson more than 30 years ago. The present work was to obtain carbon for dating of a presumed early southern San Joaquin Valley site and an "Oak Grove" (early)-culture site on the southern coast of California. Material collected from the Buena Vista Lake site is now being sorted and will be submitted for radiocarbon dating. No charcoal could be recovered in the early levels of the Rincon Creek deposit.

R. F. Heizer and M. A. Baumhoff, with National Science Foundation support, have undertaken a survey of Nevada petroglyphs, beginning in western Nevada. The long-range plan is to extend the survey to cover the entire state.

A field party of 19 members of the Archaeological Research Associates excavated a rock shelter in Joshua Tree National Monument in February. The shelter reportedly had been dug by W. H. C. and E. C. Campbell during the late 1920's but no evidence of previous digging (other than recent minor disturbance) was observed. The archaeological deposit, which was 12 to 36 inches deep, proved quite productive and a large collection of artifacts was obtained including projectile points, potsherds, handstones, milling stones, pestles, scrapers, drills, polished bone objects, and shell beads. The materials can be placed in the late prehistoric period. Roger J. Desautels and George Kritzman from the University of Southern California headed the field party.

William J. Wallace and Edith S. Taylor conducted an archaeological survey in Anza-Borrega Desert State Park in eastern San Diego County. Bow Willow Canyon in the southern section of the Park was investigated, and 18 sites recorded. All appeared to be late in time as potsherds were found on each of them. Bedrock milling stones and mescal roasting pits were particularly numerous.

National Park Service. Paul Schumacher, National Park Service archaeologist, reports progress on other NPS-supported projects. Adan Treganza, San Francisco State College, is continuing excavations on the Trinity River. William Wallace, University of Southern California, with the assistance of Alice Hunt, is continuing the site survey of Death Valley National Monument. The Bishop Museum has completed its report on the City of Refuge entitled, "The Natural and Cultural History of Honaunau, Kona, Hawaii." A University of Alaksa crew, under the direction of Frederic Hadleigh-West, is excavating at Sitka National Monument in order to locate the Russian graves and the Sitka Fort site.

Assembled by R. D. Daugherty

SOUTHWEST

The Southwest, traditionally the greatest archaeological training ground in the Americas, will see 4 regional institutions conducting field training programs for student archaeologists this summer. The University of Arizona again will be at Point of Pines on the San Carlos Apache Reservation, the University of New Mexico will continue excavations at Pottery Mound near Albuquerque, the University of Colorado will excavate a site in southeastern Utah in cooperation with the Upper Colorado River Basin Archaeological Salvage Project, and the University of Illinois, collaborating with the Museum of Northern Arizona, will conduct a field school in the vicinity of Flagstaff.

Arizona. Paul S. Martin and associates, of the Chicago Natural History Museum, after spending the winter analyzing pottery, bone, and stone implements from sites near Vernon, Arizona, will return to the same locality to investigate several pithouse villages and a well-preserved pueblo.

William C. Miller and David Breternitz, of the Musuem of Northern Arizona, will complete the survey of the Navajo Canyon drainage, begun in 1953.

Paul Ezell and Albert Schroeder have completed a survey of the Painted Rock Reservoir near Gila Bend. They found sites of a Hohokam occupation up through the Sedentary period, of the Hakataya (Yuman) into historic times, and of historic Papago. Of particular interest was a very large Snaketown-type ball court, several Casa Grande type courts and what appears to be a Sedentary period house mound.

The National Park Service is planning to excavate an jacal structure and a burial for exhibit purposes at Montezuma Castle National Monument and to make a stratigraphic test in the talus at Tuzigoot National Monument.

The Gila Pueblo collection of modern and archaeological wood specimens has been turned over to the Laboratory of Tree Ring Research, University of Arizona, by the California Institute of Technology. This collection contains about 7000 specimens and will be available for study. The Tree Ring Laboratory and the Museum of Northern Arizona are joint recipients of a National Science Foundation grant for study of the late prehistory of northern Arizona treering material; sites around Flagstaff will be studied in an attempt to provide as complete a picture, culturally and ecologically, as is possible. A demographic analysis will be attempted. The study will provide more information on the dating of pottery types and should yield useful data for Southwestern archaeologists.

The National Park Service Southwest Archeological Center, at Gila Pueblo, Globe, Arizona, formerly known as the Southwestern National Monuments Headquarters, has gradually been converted from administrative to scientific functions, since June, 1957. At present, the archaeological preservation laboratory under John F. Turney, a portion of the ruins stabilization unit under Roland S. Richert, and one naturalist, Earl Jackson, are operating at the center. Collaborator Lyndon L. Hargrave also has his headquarters there.

The preservation laboratory handles the preservation and cataloging of archaeological materials excavated or collected from various Park Service areas and provides storage for the parks and monuments lacking proper storage facilities. Comparative collections of various types

are gradually being built up for study purposes, one of the most active of which at present is the comparative collection of bird bones being assembled by Hargrave.

Extension of the functions and staff of the Center are planned as funds become available. By July, 1958, the ruins stabilization unit, headed by R. Gordon Vivian, which preserves and maintains both prehistoric and historic structures in southwestern Park Service areas, will be completely headquartered here. Efforts to develop new and longer lasting stabilization techniques will continue.

Naturalist Jackson assists the staffs of various monuments in Arizona in problems connected with their interpretive program and maintains the research library and photo files. He also manages the nonprofit Southwestern Monuments Association, which publishes trail pamphlets, popular booklets, and technical reports relating to the monuments, and which donates equipment and other material to the monuments for use in their interpretive programs.

New Mexico. Frank C. Hibben, of the University of New Mexico, reports that, in addition to conducting a field session this summer, excavations and explorations in the Gallina area in north central New Mexico will continue. Study of material from the important early man site at Lucy continues.

Stewart Peckham reports that the Museum of New Mexico plans to work a site on the Chama River near the location of the new Abiquiu Dam, under a contract with the National Park Service.

It is of interest to note that not all of the salvage projects in the Southwest are devoted to archaeology. A grant from the Laboratory of Anthropology will enable Bertha Dutton to initiate a project to salvage ethnological data and specimens among the Indians of the Southwest. The Department of Anthropology of the University of New Mexico will cooperate in the project.

As part of the Glen Canyon project, the Museum of Northern Arizona will complete the survey of the south side of the San Juan River. William Y. Adams is leading this survey.

A. E. Dittert, Museum of New Mexico, will resume work on the Navajo Dam project when weather conditions permit.

Assembled by Robert H. Lister

PLAINS

Texas. Members of the Dallas Archeological Society have been working weekends in a small rock shelter in the Lake Whitney area on the Brazos River near Blum. Material in the shelter appears to represent a component of the Toyah focus, Central Texas aspect. Sanders focus sherds from the Caddoan area have been found in association with the Toyah focus material.

John Allen Graham and W. A. Davis of the National Park Service-River Basin Surveys office in Austin made a survey of the American side of the proposed Diablo Reservoir on the Rio Grande above Del Rio, from January through March. Nearly 200 sites were listed, including rock shelters — some of them very large — pictographs, and open sites. Looting by collectors has been extensive, and will be intensified when the reservoir makes sites more accessible. On the Mexican side of the river, Walter W. Taylor, Jr., and Francisco Rul have made a survey for the Instituto Nacional de Antropologia e Historia. They report that sites are considerably less frequent than on the American side. Plans are being made for a major salvage project on the American side, which will take several years.

Oklahoma. Reservoir salvage archaeology by the University of Oklahoma will be continued throughout the summer of 1958 under the direction of Robert E. Bell. Contract agreements between the National Park Service and the University of Oklahoma Research Institute, in cooperation with the U.S. Army Engineers, the Bureau of Reclamation, and the Soil Conservation Service, will permit reconnaissance and survey as well as excavation in specific reservoir areas. A reconnaissance with minor testing of important sites will be undertaken in 3 areas: (1) the Short Mountain Reservoir on the Arkansas River in the region south of Sallisaw, which may produce Caddoan sites of both Gibson and Fulton periods; (2) the Waurika Reservoir in south central Oklahoma along Beaver Creek, an unknown area of the state; (3) a series of some 33 small reservoirs in the Sandy Creek Watershed near Ada, which affers the possibility of establishing clearer Plains-Caddoan relationships. Throughout the year as time permits, reconnaissance and survey is being undertaken at the Lake of the Arbuckles Reservoir near Sulphur, the Deep Fork Watershed near Bristow, and the Wewoka Watershed near Wewoka.

The University of Oklahoma archaeological field school will be at the Harlan site in the Fort Gibson Reservoir near Wagoner; eight weeks will be spent in examining 2 mounds. Excavations made in 1949 and 1950 indicate the importance of this site as an example of the Gibson period in eastern Oklahoma. The 1958 season at the Harlan site will augment available data to make it the best-documented Gibson component for the Caddoan area.

In December, 1957, test excavations were conducted at the Lee II site (Gv-4) near Lindsay, to add to knowledge of the Washita River focus.

James B. Shaeffer, Director of Highway Salvage for Oklahoma, has continued his operations. During the period from May 15, 1957, to February 15, 1958, 22 occupational areas were found during the course of highway survey. Ten of these areas have been recommended for excavation; 5 of the excavations have been completed and 5 are awaiting final authorization. From a preliminary survey of the recovered data, it is clear that this program has contributed to our knowledge of Oklahoma's prehistory. Not only have new cultural complexes come to light but work has been directed to areas which were otherwise neglected.

In the laboratory Robert E. Bell continues his preparation of a final report on the Harlan site in Cherokee County. A. D. Buck is preparing a report on the Phillips and Mouse sites of Custer County in western Oklahoma,

and Lathel Duffield is completing his study of the Spiro mound engraved shells. O. F. Evans is continuing his studies of flint specimens, quarry identification, and the sources utilized by specific cultural groups.

KANSAS. Roscoe Wilmeth of the Kansas State Historical Society Museum will be carrying on reservoir salvage surveys, in cooperation with the National Park Service, in the Pomona and Melvern reservoirs about 35 miles south of Topeka, on Dragoon Creek and the Marais des Cygnes River respectively. He also plans to test at the Anderson site, which will probably soon be destroyed by construction of a Topeka city park.

NEBRASKA. Marvin F. Kivett and Tom Witte of the Nebraska State Historical Society will be doing highway salvage survey work this summer. Some new sites have already been reported by amateurs who are cooperating in the highway survey work.

MISSOURI BASIN CHRONOLOGY PROGRAM. Robert L. Stephenson reports the following: In December, 1957, the Missouri Basin Project of the Smithsonian Institution in Lincoln initiated a coordinated Chronology Program within the Missouri River Basin. The staff members of the Missouri Basin Project are acting as a coordinating committee and all interested archaeologists in the Plains are participating. The program will assay the current status of chronology for the area and attempt to add specific dates, both absolute and relative, for culture units in the Missouri Basin. The intent is to coordinate all available resources in a program using dendrochronology, radiocarbon, geologic-climatic methods, palynology, historic documentation, comparative artifact analyses, and all other dating methods available. As a first step current Missouri Basin dates and sequences are being analyzed. Concurrently, the initial group of radiocarbon materials has been submitted for testing, treering data are being assembled, and the geologic-climatic phase of the program has begun. Studies of pollen have also been started.

SOUTH DAKOTA. Six Missouri Basin Project parties will be at work in the Big Bend Reservoir area on the Missouri. Three parties will camp together on the left bank near Fort Thompson and will work at the Medicine Crow site and nearby sites and also in the area of immediate construction activities for the Big Bend Dam. The other 3 parties will camp together on the right bank in the vicinity of the Neck of the Big Bend itself, and will work at the Black Partizan site and nearby sites.

The University of South Dakota, the South Dakota Archaeological Commission, and the National Park Service will cosponsor this summer a project at the Four Bears site, 39DW2, Dewey County. This is thought to be a village visited by Lewis and Clark in 1804. Plans call for excavation of houses and trenching of the midden deposits. Wesley R. Hurt will be in charge.

The Missouri Basin Project will have 6 field parties in the Oahe Reservoir area. Three parties will camp on the left bank of the river in Sully County and will work on the village and cemetery at the Sully site, and the Sully School site, and will test at additional nearby sites. Three other parties will be camped on the right bank, excavating in the vicinity of Fort Bennett and mapping and testing a number of the larger village sites on both sides of the river.

WYOMING. The spring semester class in archaeological field work at the University of Wyoming, under William T. Mulloy, spent 10 Saturdays working in a Late Prehistoric camp site about 3 miles north of Laramie. The site is unusual in that it consists of stone circles which are actual habitation sites and are associated with Late Prehistoric, rather than the usual Middle Prehistoric, materials.

For at least a month during the summer, a joint party sponsored by the National Park Service, the Wyoming State Museum, and the University of Wyoming will return to the Glendo Reservoir on the North Platte River in the southeastern part of the state, to investigate Middle period sites. Members of the Wyoming Archaeological Society will probably be participating in this work. The party will be jointly led by Mulloy and by Louis Steege of the Wyoming State Museum.

David Gebhard and a field party from the Roswell Museum, New Mexico, will return for another season of work in the cave shelter sites of the upper Wind River Valley, and will continue the archaeological survey of the middle and upper Big Horn Basin.

MONTANA. Carling I. Malouf of the University of Montana, Missoula, plans to do survey and excavation in the Three Forks area of the Missouri River. Dee C. Taylor plans to dig a large buffalo jump site near Ulm. There are also plans for survey work in the area around Great Falls.

SASKATCHEWAN. The Saskatchewan Museum of Natural History at Regina reports a radiocarbon determination of 5350 ± 250 years from a site at Oxbow near Estevan in southeastern Saskatchewan. The site contains small side-notched and indented-base points. The date was determined at the radiocarbon laboratory of the University of Saskatchewan at Saskatoon.

ALBERTA. An archaeological technician, Don King, has been added to the staff of the Glenbow Foundation at Calgary. Richard G. Forbis, archaeologist for Glenbow, reports that 2 parties will be in the field this summer, one in northern Alberta and one in southern Alberta. They will be checking collections and testing promising localities, both historic and prehistoric.

Assembled by E. MOTT DAVIS

UPPER MISSISSIPPI VALLEY

ILLINOIS. The Illinois Archaeological Survey met in Chicago on March 21. The main order of business was a discussion of Late Woodland ceramic types under the chairmanship of James B. Griffin.

Joseph Caldwell of the Illinois State Museum is in the field this spring conducting a series of test excavations at key sites to obtain charcoal specimens for radiocarbon dating. An Illinois State Museum party will excavate

this summer in Hopewellian sites in southern Illinois to get data on settlement patterns in order to make estimations of population size.

MISSOURI. The 12th Field Session in Midwestern Archaeology of the University of Missouri will be held this summer for 8 weeks in the southeast part of the state. It will be under the direction of Richard O. Keslin and will concentrate on the excavation of a number of salt pan sites in and near Ste. Genevieve County.

Research will continue in the Pomme de Terre Reservoir area under a grant from the National Park Service and W. Raymond Wood will again be in charge. Richard A Marshall will direct further work near Meramec Springs under a grant from the Lucy Worthington James Foundation; it is expected to complete preliminary investigations of a shelter, a mound, and a village site. The final work in the Table Rock Reservoir area will be conducted during the spring and summer if the reservoir does not fill again. There is no doubt that this is the last opportunity to learn anything from the reservoir area and work will be concentrated on the ceremonial site and a recently discovered historic trading post near the mouth of James River. Carl H. Chapman will be in charge. Research will be resumed in the cave in Callaway County, supervised by J. Mett Shippee.

OHIO. Plans for the 1958 season call for continuing the explorations of the Zencor site (Late Wodland) begun last year. The work will be sponsored jointly by the Ohio State Museum and the Ohio State University, under the direction of Raymond S. Baby. Preliminary investigation of a number of rock shelter sites in the upper Hocking Valley, just south of Lancaster, is being planned for the spring and fall.

Assembled by M. L. FOWLER

NORTHEAST

GENERAL. John L. Cotter reports that archaeological activity in Region Five of the National Park Service, covering the northeastern part of the nation, has increased, and the prospect of future investigations is promising.

G. Hubert Smith, on loan to the National Park Service from the Smithsonian Missouri River Basin Surveys, is conducting exploratory excavations at Fort McHenry, Baltimore, to check historical references and provide data for interpretive development. In particular, the location and nature of the shore battery of 1812, now completely obliterated above the present grade, will be sought. Action from this battery, which lies between the shore and the Star Fort, helped keep the British ships at a safe distance from Baltimore.

At Independence Hall National Historical Park, B. Bruce Powell is completing a report on excavations in Independence Square, which were started by Paul J. F. Schumacher 2 years ago and completed by Powell in November, 1957. The remains of several 18th century structures, including homes and outbuildings, a well, walls, walks, and brick drainage systems were exposed. Information on early landscape development in the Square and a great many 18th and 19th century artifacts were found. The artifacts from Independence Square and other sites form a large and important collection of artifacts associated with everyday life from the 18th and 19th centuries. Plans are now being laid for the complete exploration in 1959 of the site of Benjamin Franklin's home in Franklin Court. Preliminary excavations have indicated at least a part of the cellar, and foundations of the house still remain beneath a modern street; it is hoped other features on Franklin's property may be recovered.

Archaeological investigations at Fort Washington in Maryland on the Potomac River are scheduled for the summer by B. Bruce Powell. Powell will be loaned to the National Capital Parks from his present staff position at Independence Hall National Historical Park.

Other archaeological investigations in the northeastern National Park Service region are contemplated at Harpers Ferry National Monument, Acadia National Park, and Isle Royale National Park. Plans are now being completed for museum displays in a new visitor center building at Mound City Group National Monument, Chillicothe, Ohio, together with improved site interpretation, all to be undertaken within the next 2 years.

Two archaeological survey units are being implemented for the summer of 1958 on contract with the National Park Service. The first, with Douglas F. Jordan of Harvard University, involves 4 reservoirs in New England: Otterbrook, New Hampshire; Buffonville and Barre Falls, Massachusetts; and Ball Mountain, Vermont. The second contract, with Jacob W. Gruber, Temple University, is for surveys in Bear Creek, Dyberry, Prompton, and Stillwater reservoirs in Pennsylvania.

DELAWARE. The Sussex Society of Archeology and History has completed a report on its archaeological survey which was undertaken at the request of the Delaware Archeological Board. The survey includes 105 sites in Sussex County, and 57 sites in neighboring counties in Maryland; the report is on file in the Delaware State Archives, Dover. The sites in Maryland have also been recorded with the Archeological Society of Maryland. Three of the historic sites have been excavated by the Society; 31 sites have been more or less excavated by parties with archaeological interests and some records made; seven of these have been excavated by members of the Society and reports published in "The Archeolog."

MASSACHUSETTS. The Cohannet Chapter of the Massachusetts Archaeological Society will continue excavation of an archaic village site at Assawompsett Lake in Middleboro during the 1958 season. Trenches will be carried to the north and east in an attempt to discover the limits of the village area and to determine the exact number of lodges of which the village was composed. An intensive search will also be made of the area in which 4 secondary cremation burials were found during the last few weeks of the 1957 season. It is hoped that the horizon from which the fluted points and associated artifacts were recovered during the past 2 seasons may be located.

NEW YORK. Major archaeological excavations continue at Philipsburg Manor, Upper Mills, in North Tarrytown, New York. Philipsburg Manor, Upper Mills, and Sunnyside, home of Washington Irving, are owned and operated by the Sleepy Hollow Restorations, a subsidiary of the Rockefeller Foundation. Harold Dean Cater is director; Robert Wheeler is director of research; Roland W. Robbins, as head archaeologist, is continuing the major excavations which he began in September of 1956. The excavations are revealing the Dutch way of life which began here in 1683 and prospered for nearly 100 years. Present excavations are concentrating in the plaza between the mansion house and the mill. Test trenches have unearthed the original surface located from 5 to 10 feet below the present surface. This work will determine the original topography of the area, the location of the original dam, and the earliest mill building. In anticipation of the summer crowds, an exhibit room has been set up at the restoration, containing many of the finer archaeological artifacts found. 18th century wooden ship timbers and belaying pins, a large iron kettle, implements and products of the carpenter's and blacksmith's trades, partially restored earthenware, and a special case featuring "finds" made by the visitors to the restoration who participated in the active dig-it-yourself program are a few of the many exhibits.

Joining the ranks of archaeological societies is a new organization, The New York City Archeological Group, 220 Cabrini Blvd., New York 33, N.Y. Officers are: Director, Julius Lopez; Associate Directors, Stanley Wisniewski, Julius Diosi, Harold Trowbridge; Executive Secretary, Michael Cohn. The objectives of the Group are explorations and a series of excavations in the New York coastal area, with particular emphasis on sites in the Greater New York City region. The program envisioned also includes the photography and study of the many collections in private and institutional hands for publication purposes. To achieve this, membership will be restricted to seriously interested persons and to students of anthropology at colleges and universities in the aren. Several sites have already been excavated by the Group and others are in progress.

PENNSYLVANIA. The Pennsylvania State Museum has scheduled field work at the Albert Ibaugh site, Washington Boro, and the Oscar Leibhart site, Long Level, Lancaster and York counties respectively. Both are historic Susquehannock sites and have been excavated over the past few years. The excavation of several burials at Ibaugh's and the postmold pattern of a longhouse at Leibhart's is planned. The work will be filmed in color and later expanded in order to produce a short movie illustrating the research, exhibit, and educational aspects of museum work. If time permits excavations begun last fall will be continued on the Bare Island site, Lancaster County, a probable Late Archaic site with a Transitional soapstone component. The State Museum expects to have a field crew of 4 students working under Kinsey's supervision.

The Society for Pennsylvania Archaeology is planning a memoir to be published late this year or early 1959 on Susquehannock history and archaeology. The memoir will be the result of papers presented at the annual meeting of the society May 31 at Franklin and Marshall College, Lancaster.

Extensive work on the archaeological exhibits are now underway at Carnegie Museum by James L. Swauger and Don W. Dragoo. The new exhibits will present the cultural picture of the Upper Ohio Valley as revealed by the Carnegie Museum's archaeological programs.

The major field project for Carnegie Museum during 1958 will be the excavation of an Adena mound in cooperation with the West Virginia Archeological Society. The work at this mound, near the Welcome Mound excavated recently by Frank M. Setzler of the U.S. National Museum, will be under the direction of Don W. Dragoo. Site surveys and collection studies will also be continued in various areas of the Upper Ohio Valley during 1958.

ONTARIO. During the 1957 season, the Royal Ontario Museum carried out 2 months' field work on a large site near Inverhuron, on the eastern shores of Lake Huron. This proved to be a fishing station dating back from prehistoric Iroquois times to the Archaic. It was apparently never a permanent habitation site. The work was a cooperative enterprise of the Museum and the Ontario Division of Parks. At the close of this work, the Museum made a 2 month survey of the archaeological resources of the English River, Patricia District, with the help of the Hydro-Electric Power Commission. Twenty-one sites were examined, and samples of material collected from each. Five sites of some size were found, the majority of Black Duck affiliations.

Work continued as in the past 2 years on the Serpent Mound near Peterborough, where 20 inhumations were uncovered. Cultural material, however, was negligible and insufficient to afford any secure identification. As in the past, the work was done by the Museum with the assistance of the Division of Parks and the Serpent Mound Foundation.

Finally, in cooperation with the Division of Parks and the Quetico Foundation, a beginning was made in recording the pictographs in the lakes' head area. Some 50 individual paintings, at 7 different sites, were copied and are now stored at the Museum.

The work at Inverhuron and the English River was carried out by Walter Kenyon; that at Serpent Mound by Richard B. Johnston, while Selwyn Dewdney, an artist, made the pictograph recordings.

Assembled by ALFRED K. GUTHE

SOUTHEAST

FLORIDA. Florida State University has continued excavations in the Delp Mound, an apparently untouched burial mound dating from the Deptford or Santa Rosa-Swift Creek periods. Two badly decayed flexed or bundle burials have been found high up in the mound. Glenn

Allen and Edward Dolan are re-examining the presumed early man materials excavated by the Florida Geological Survey some years ago. The Clovis-like points came from fill in solution holes in the neighborhood of various big springs. It seems that typological descriptions will be about all that can be recovered. More Poverty Point type clay objects have been found at a number of sites in western Florida. From the same area a number of small, human, pottery effigies are turning up, apparently associated with the Santa Rosa-Swift Creek complex.

The University of Florida has discovered, and is working on, the Oven Hill site, 18th century Seminole in date. John Goggin reports that this site, on the Suwannee River, is at, or near, the historic Bowlegs Town destroyed by Andrew Jackson in 1818, although Oven Hill is clearly earlier. Excavations have resulted in a wide variety of the 2 basic forms of known Seminole pottery, small smoothed bowls and larger brushed ware jars. Some were certainly brought in from outside Florida. Considerable metal trade material is present with knives, axes, and broken gun parts being most abundant. Other trade objects include gun flints; white pipe fragments; glass bottle and mirror fragments; brass, pewter, and iron buckles; buttons; glass beads; and silver trade ornaments. European ceramics are scarce with a few sherds of Delftware and lead-glazed wares being represented. These, together with the metal objects, suggest a date of about 1760-1770 for the site.

Ripley Bullen, Florida State Museum, and Frederick Sleight, Central Florida Museum, sponsored by the William L. Bryant foundation, have completed 2 weeks of work in the Green Mound, on the Atlantic Coast below Daytona Beach. Excavations in the 26-foot deep mound produced specimens, in stratigraphic sequence, of the St. Johns I and II periods.

Highway salvage excavations, sponsored by the Florida Committee for Highway Archaeological Salvage and the State Road Department, have recently been necessary at a number of sites. Included are test excavations in sites covering very long time ranges, preceramic to protohistoric, south of Gainesville. nOe job was done by Ripley Bullen and two by John Goggin. Sears dug 2 large test pits in the Grant site on the lower east coast. A very large ceramic sample seems confined to Rouse's Malabar II period.

GEORGIA. A. R. Kelly and University of Georgia students conducted a salvage dig at the Watson Springs mound on the Oconee near Athens. This 2-mound site, with a large plaza area between the mounds, has never been cultivated. It is hoped that architectural details for the temple structure on top of the main mound may be recovered before these features are demolished by local collectors. During the winter Kelly and David Chase continued excavations at the Halloca Creek site. They have excavated a large Early Swift Creek period refuse pit which has yielded 2 restorable pots and 600 other specimens. Partly coeval with and partly antecedent to the Swift Creek occupation is a localized stratum characterized by St. Andrews Complicated Stamped and coarse sand-tempered plain pottery. Kelly and C. S. Knowlton have made a survey of a 3-acre site on the Ogeechee River drainage a few miles from Statesboro. Surface collections and test pits indicate a late Archaic-Stallings Island horizon with an overlay of drag and jab punctated pottery which in turn intergrades into a heavy grit or coarse, sand-tempered plain ware. The plain appears to have developed out of the fiber tempered, and some sherds have both kinds of temper. The University of Georgia will operate a fifth summer field session at Etowah during July and August, with A. R. Kelly and Lewis Larson as instructors.

Assembled by W. H. SEARS

MIDDLE AMERICA

As this is written in March, the winter expeditions are still in the field, and little news is reaching us at the moment. We hear, however, that a new and immensely important stela has been uncovered at Kaminaljuyú, Guatemala, where excavation continues under the direction of Gustavo Espinosa of the Instituto de Antropología e Historia. According to information received from E. M. Shook, who was in Guatemala at the time and participated in the discovery, the monument was lying under a deposit of late Preclassic date, and definitely establishes that there was a highly evolved artistic style here no later than the Arenal ceramic phase, and very probably earlier. The monument is in mint condition and shows specific traits in common with stelae at Izapa and with the earliest known Lowland Maya carvings. It was found on the Quinta de Samayoa, not far from the stone discovered in 1956, confirming that the date of this is also Preclassic. The 2 discoveries open to view a previously unsuspected period of sculpture that may revise our notions of the level of civilization reached in this area before the Classic era.

Gordon R. Willey and A. L. Smith of the Harvard expedition spent a week at Altar de Sacrificios, where they made a number of test pits with very encouraging results. Michael Coe has been finding deep stratigraphy at the site of Ocos, on the Pacific coast of Guatemala and has recovered a large collection of pottery there. It has been reported that recent activities of oil companies in the Petén region have revealed a number of new sites, and with the attention of several of our institutions focused on this area we should expect to hear of further discoveries from Guatemala in the very near future.

We have only scattered news at present of activities in Mexico, which will be summarized in our next issue, but we want to mention here the opening of the new Museo de Prehistória de México at Tepexpan, State of Mexico, on February 28 of this year. The Instituto Nacional de Antropología e Historia now includes a Dirección de Prehistória in charge of Arturo Romano.

Assembled by TATIANA PROSKOURIAKOFF

HIGHLAND SOUTH AMERICA

CHILE. Thomas Barthel of the University of Hamburg, Germany, and Ruperto Vargas of the Centro de Estudios Antropológicos of the University of Chile, who recently conducted an expedition to Easter Island, are reported to have discovered several large female stone statues, and to have established a chronological sequence of local stone sculpture. This is the first time that female statues have been reported from Easter Island.

Further excavations by members of the Sociedad Arqueológica of Viña del Mar, at the preceramic burial site of Las Cenizas, suggest that this cemetery forms part of the same complex which is characterized by large rocks with cup-shaped, ocher-filled depressions ("Piedras Tacitas"). A new site of the latter complex was recently discovered by Hans Niemeyer of the Sociedad Arqueológica of La Serena, in the vicinity of Paloma. The cultural materials of Las Cenizas have been put on permanent exhibition in the Museum at Viña del Mar.

Jorge Iribarren Charlin of the Museo Arqueológico of La Serena has lately worked at Huatulame, and reports his discovery of a burial ground of the preceramic shell-fishhook period. Oswald Menghin, assisted by members of the Centro de Estudios Antropológicos, is conducting a survey of archaeological sites in the Araucanian area, while Jean Empéraire, also accompanied by members of this institution, is working in the shell middens of the Magallanes area.

COLOMBIA. During January and February, 1958, Gerardo and Alicia Reichel-Dolmatoff made an extensive survey of the Urabá region, and of the lower Atrato River and its western tributaries. Many sites, consisting mostly of dense occupational refuse, were explored on the shores of the Gulf of Urabá. Several straticuts reached a depth of 10 feet. Practically all cultural remains belong essentially to the Tierra Alta phase of the Sinú drainage, the time position of which is relatively recent. Related cultures were found scattered sporadically on the affluents of the Lower Atrato, but no sites whatsoever were located on the narrow levees nor on the backswamps of the main river. In the course of these explorations toward the Panamanian border, data on possible aboriginal migration routes were collected. It was found that, although most of this area is covered by tropical rain forest, the physical conditions of the terrain do not present a serious obstacle to overland communication between Panama and Colombia. Many good mountain-pass routes offer easy access to the regions along the Pacific and Caribbean coasts, and connect the upper Chucunaque and Tuira-Paya drainages with the Lower Atrato and Urabá.

In a short survey of the foothills and lowlands to the south of the Sierra Nevada de Santa Marta, the Reichel-Dolmatoffs found several new sites, all of them belonging to the more recent cultural developments on the lower Magdalena River. Near Zambrano a long local sequence was established by cutting through 18 feet of occupational refuse. This is the deepest site discovered so far in Colombia.

ECUADOR. The recently discovered architectural complex at Minda, on the headwaters of the Napo River, has been partially investigated by Father Ignacio Porras Garcés. At present, Emilio Estrada is working on the ceramic and lithic materials recovered there. According to Estrada, the site is Panzaleo and seems to have been a stronghold against Incaic invasions. However, both pottery and stone scultpures show resemblances to the San Agustín-Tierradentro cultures of Colombia and thus suggest an earlier time position. Estrada also reports new discoveries on the coast. Near Machalilla several sites were found which are slightly later than Valdivia. One of their outstanding features is stirrup-handled vessels.

PERU. The San Marcos University's project in field archaeology on the Peruvian coast entered into actual field operations the first week of September, 1957. This project was made possible by coordinating, for the first year, 3 Fulbright Research Fellowships. Its aims are (1) to make a general survey of all coastal valleys and areas containing sites threatened by either irrigation or urbanization projects, and (2) to establish by excavation any interrelated culture sequences that exist between the 3 main coastal regions: North, Central and South. The work as presently projected will cover a period of 2 years. During the first year 3 archaeological expeditions will carry out the general survey and excavation work. It is contemplated that during the second year, there will be conducted a physical anthropological study of specimens — both those presently existing but heretofore unexamined, and those resulting from the current and forthcoming excavations.

The project has a training as well as a research function. Graduate students in archaeology and anthropology at San Marcos University are acting as field assistants with the various expeditions, and are aiding in laboratory and museum work. These assistants are being rotated so that at the end of the project each student will have had actual field experience in all regions of the coast. All archaeologists connected with the project, whether students or professors, are convening at more or less regular intervals, either in Lima or in the field, for formal and informal discussions and lectures.

As of March 1, 1958, the following areas had been intensively studied and the field survey work in them could be considered, for all practical purposes, concluded: Pisco, Chincha, Cañete, Lurín, Rímac, and the zone from the northern edge of the Sechura Desert to the north bank of the Chira. Surveying is proceeding at present in the following areas: Ica, Huaura, and Chira-Zarumilla. In addition, considerable, but as yet incomplete, survey work is being done in the Jaguey-Chincha zone, the Asia Valley, and the Culebras-Huarmey-Casma area. Excavation work has also begun. Small-scale excavations have been carried out in the Chincha, Cañete, and Quirós valleys. In the latter, the excavators were able to salvage archaeological collections and physical anthropological specimens from sites located behind the already completed dams of the vast Quirós irrigation project only weeks before such sites were to be inundated perma-

nently. In the Chincha and Cañete valleys the excavations have tended to justify the premise that the line of demarcation between the Central and South coasts was between these 2 valleys, and also to establish coordinated culture sequences for the 2 regions. An interesting sidelight has been the discovery of a considerably more northward spread of the Paracas style than had previously been established.

The work of this project has been proceeding under the direction of the Instituto de Etnología y Arqueología of San Marcos University, whose director is Luís E. Valcárcel. The archaeologists involved at present are David H. Kelly on the north coast, Louis M. Stumer on the central coast, and Dwight Wallace on the south coast. Final selection of the archaeologists for the year 1958-1959 has not yet been made. Physical anthropology will be conducted by Marshal T. Newman. The project has been fortunate in having the complete cooperation of all Peruvian government agencies involved, so that its broad-scale objectives are being smoothly carried out.

During the week of January 7-13, 1958, the Instituto de Etnología y Arqueología sponsored a series of round-table discussions in physical anthropology, social anthropology, and archaeology, with its director, Luís E. Valcárcel presiding. The organizing committee consisted of Jorge C. Muelle, Richard P. Schaedel, Louis M. Stumer, and José Matos. Some 20 papers were presented in the field of archaeology, 3 in physical anthropology, and 25 in social anthropology. There being an extraordinary number of visiting anthropologists and archaeologists then in Peru, it was the aim of the round table to utilize the opportunity thus provided for an exchange of new ideas and a recapitulation of recent progress. The proceedings of the various sessions, including the papers submitted, were tape-recorded, and are being edited by the participants. The final results will appear as a publication of the Instituto. In addition to the formal sessions, the Instituto was host to the group on various other related occasions, including a visit to the current excavations of Fréderic Engel in Early Formative deposits in the Asia Valley.

Work on the cleaning and partial restoration of one of the ceremonial structures located southeast of the Temple of the Sun at Pachacamac is at present proceeding under the auspices of the Dirección de Arqueología of the Ministry of Public Education. Actual direction of the work is in the hands of Arturo Jiménez Borja, who recently finished a similar undertaking at the site of Puruchucu on the hacienda Vista Alegre in the Rímac Valley. During the course of the present work at Pachacamac, a stratigraphic examination was made by San Marcos University of a midden associated with the ceremonial structure, results of which would seem to disclose that the edifice dates from the late Kingdoms and Confederations and early Imperial epochs. In other words, ceramics encountered are of the Inca Associated and Coastal Inca styles.

Other sites contemplated for cleaning and restoration under the same auspices are San Juan in the Rímac Valley and Huaca Pan de Azúcar in San Isidro, a residential district of Lima.

Museum facilities are being constructed adjacent to Puruchucu to house recent Central Coast material for which there is insufficient space in present Lima museums. The net result will be much larger facilities for study of pre-Colombian cultures in the Lima area, for scholars and tourists alike.

Assembled by G. REICHEL-DOLMATOFF

LOWLAND SOUTH AMERICA

BRAZIL. The Centro de Ensino e Pesquisas Arqueológicas of the University of Paraná completed its first year of activity in February, 1958, under the direction of José Loureiro Fernandes. Field work was under the supervision of the French archaeologists, J. Emperaire and A. Laming-Emperaire, who are collaborating with the Centro. Several students participated in the investigations as part of the training program. The following information on the activities of the Centro has been furnished by Oldemar Blasi.

Two samabqui sites were examined during the 1957 season, with 5 weeks of excavation devoted to each of them. The sambaqui of Guaraguaçu, near the town of Paranagua, is a shellmound of the classic type. It is 300 m. long, 21 m. high, and the contents are undisturbed. During the field session, 15 burials were excavated, and bone and chipped stone artifacts were recovered. Efforts are being made to derive stratigraphic information from the deposit. The second sambaqui, on the Ilha do Corisco, Baía de Antonina, is of considerable interest because its present situation is the opposite of that usually encountered. Rather than being on an old beach now inland from the shore, it is submerged, suggesting that the water level is higher now than it was at the time of occupation. The fact that most of the shells are oyster, the absence of polished stone artifacts, and the abundance of large bifacial chipped tools all suggest considerable antiquity for this site, and further excavations are planned.

Work was also initiated on 2 sites in the interior. One in the Municipio of Barracão, in the western part of the State of Paraná, produced a lithic industry not previously found in Brazil, but similar to materials from the Território de Missiones, Argentina. The artifacts were unfortunately encountered on an eroded slope and the original site could not be identified. The site of José Vieira, on the Rio Ivaí, is more encouraging. Here, a level containing pottery and chipped stone artifacts is separated stratigraphically by a sterile layer from an underlying level containing only stone artifacts. This is the first site with this stratigraphic sequence found in southern Brazil, and in view of its significance further work is planned during 1958.

Assembled by BETTY J. MEGGERS

SOME RECENT PUBLICATIONS

This annual bibliography, assembled by the *Notes and News* editors, is intended to list all publications in American archaeology not included in previous years. Omissions should be called to the attention of the appropriate regional editors; they will be listed in next year's bibliography. Articles appearing in AMERICAN ANTIQUITY are not included. This year's list contains 466 titles.

The following abbreviations are used in the references:

AA	*American Anthropologist*, n.s. Menasha.
AHG	*Antropologia e Historia de Guatemala*. Guatemala.
APS-P	*American Philosophical Society, Proceedings*. Philadelphia.
APS-T	*American Philosophical Society, Transactions*. Philadelphia.
Ar	*Archaeology*. Cambridge.
ASNJ-B	*Archeological Society of New Jersey, Bulletin*. Trenton.
ASNJ-N	*Archeological Society of New Jersey, Newsletter*. Trenton.
BAE-B	*Bureau of American Ethnology, Bulletin*. Washington.
CA	*Cuadernos Americanos*. Mexico.
CIAM-B	*Centro de Investigaciones Antropológicas de México, Boletin*. Mexico.
CIW-CR	*Carnegie Institution of Washington, Current Reports*. Washington.
CIW-NMAAE	*Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*. Cambridge.
CIW-P	*Carnegie Institution of Washington, Publications*. Washington.
CM-AN	*Carnegie Museum, Archaeological Newsletter*. Pittsburgh.
E	*Ethnos*. Stockholm.
EP	*El Palacio*. Santa Fe.
ESAF-B	*Eastern States Archaeological Federation, Bulletin*. Trenton.
FiA	*Fieldiana — Anthropology*. Chicago.
FlA	*Florida Anthropologist*. Gainesville.
GJ	*Journal of Geology*. Chicago.
ICA	*International Congress of Americanists*. Anais do 31 Congresso Internacional de Americanistas, São Paulo.
JSAP	*Societé des Américanistes de Paris, Journal*, n.s. Paris.
K	*Kiva*. Tucson.
KAS-P	*Kroeber Anthropological Society, Papers*. Berkeley.
MARI	*Middle American Research Institute*. New Orleans.
Mas	*Masterkey*. Los Angeles.
MAS-B	*Massachusetts Archeological Society, Bulletin*. Attleboro.
MN	*Mesoamerican Notes*. Mexico.
MNA-B	*Museum of Northern Arizona, Bulletin*. Flagstaff.
MNA-CS	*Museum of Northern Arizona, Ceramic Series*. Flagstaff.
MoA	*Missouri Archaeologist*. Columbia.
NH	*Natural History*. New York.
OA	*Ohio Archeologist*, n.s. Dayton.
OAS-B	*Oklahoma Anthropological Society, Bulletin*. Norman.
OAS-NL	*Oklahoma Anthropological Society, Newsletter*. Norman.
P	*Plateau*. Flagstaff.
PA	*Pennsylvania Archaeologist*. Homesdale.
PlA	*Plains Anthropologist*. Lincoln, Nebraska.
RMP	*Revista do Museu Paulista*. São Paulo.
S	*Science*. Washington.
SA	*Scientific American*. New York.
SIS	*Southern Indian Studies*. Chapel Hill, North Carolina.
SJA	*Southwestern Journal of Anthropology*. Albuquerque.
SL	*Southwestern Lore*. Boulder, Colorado.
TA	*Tennessee Archaeologist*. Knoxville.
TAS-B	*Texas Archeological Society, Bulletin*. Austin.
TAS-MP	*Texas Archeological Society, Miscellaneous Papers*. Austin.
UA-AP	*University of Alaska, Anthropological Papers*. Fairbanks.
UCAS-R	*University of California Archaeological Survey, Reports*. Berkeley.
UU-AP	*University of Utah, Anthropological Papers*. Salt Lake City.
VFPA	*Viking Fund Publications in Anthropology*. New York.
WHOM-N	*W. H. Over Museum, Newsletter*. Vermillion, South Dakota.
ZE	*Zeitschrift für Ethnologie*. Braunschweig.

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